Improving System Reliability

With

Community Asset Microgrids

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Community Asset Microgrid Goal

Meet needs of community customers

- Meet facility's peak demands
- Potential demand response resource

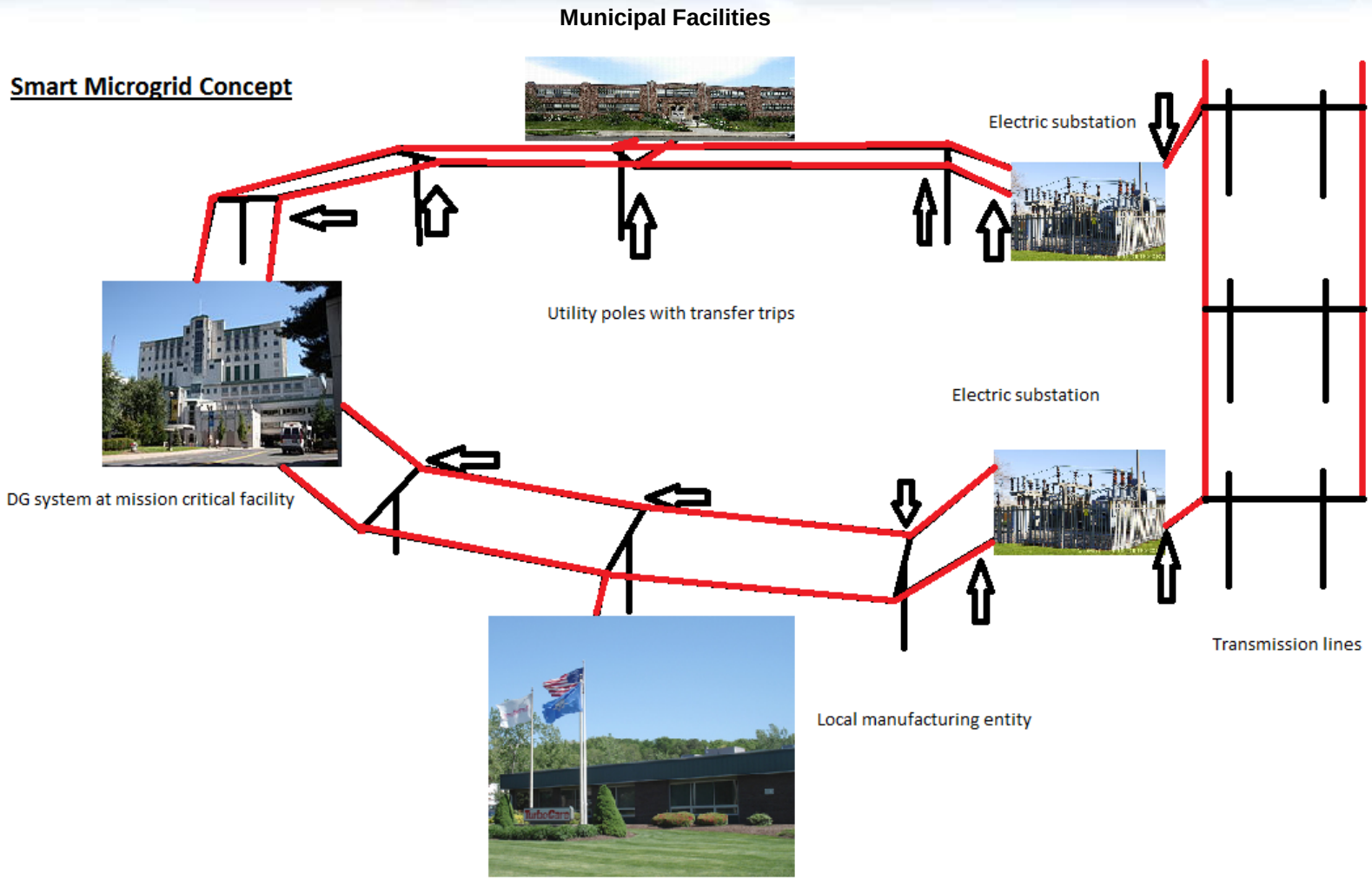
Meet needs within a distribution area

- Meet area peak demands
- Increase grid reliability

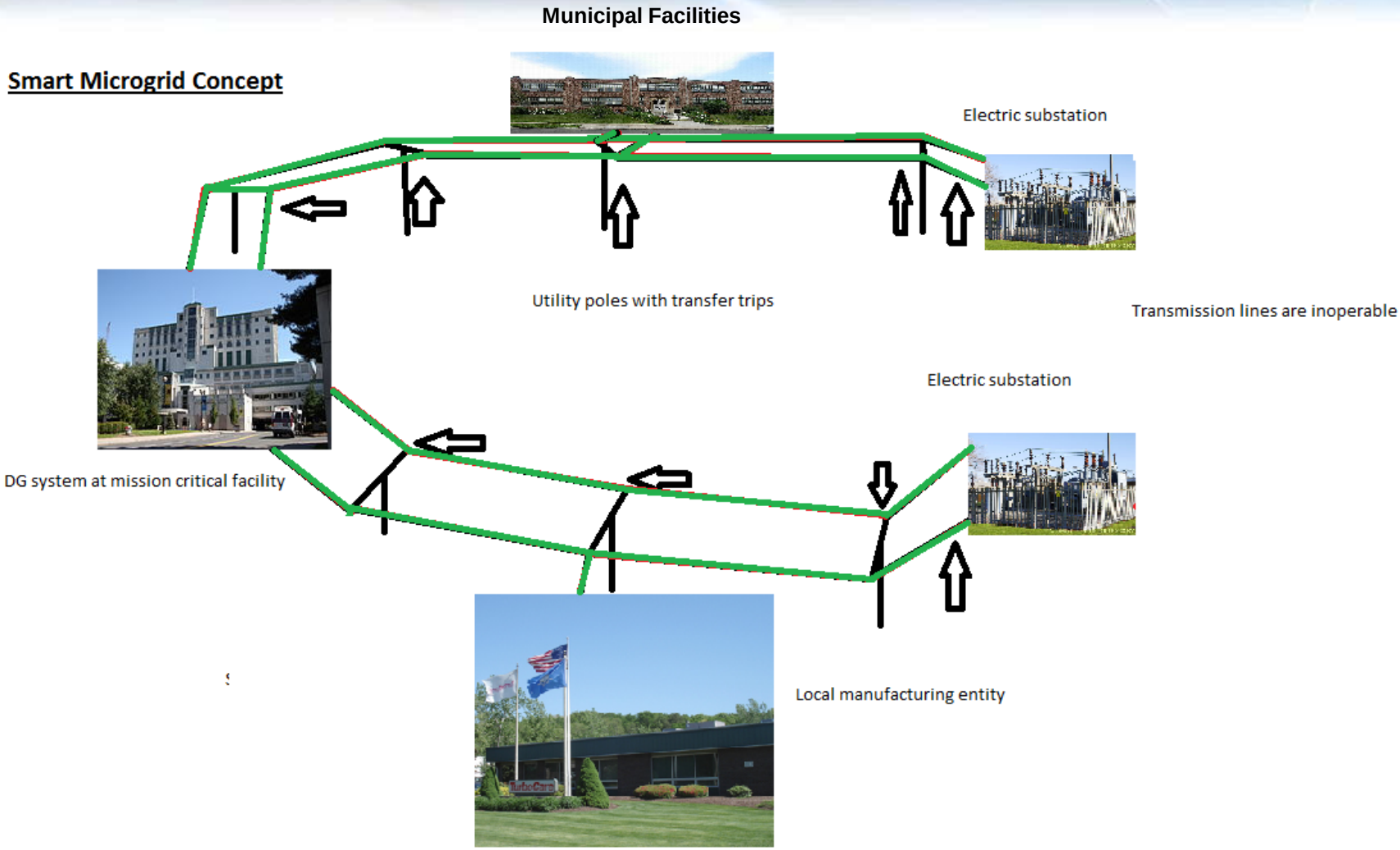
Community Asset Microgrid Criteria

- Reduced impact of outages on key facilities
- Reduced impact of outages in selected areas
- Reduced economic output losses
- Improved power reliability
- Increased use of high efficiency and renewable generation

Smart Grid Running on Grid Power



Smart Grid Running on DG System



Community Asset Microgrid Buildout

- Distributed resource provides power to customer(s) and islanded distribution grid
- Facilties selected by community and approved by PURA
- Microgrid and transfer trip scheme operated by utility
- Automated demand response and outage protocols operated by utility
- Generation assets owned and operated by utility

Development of plan for deployment and operation

- Identify critical community facilities
- Characterize area load requirements
- Analyze power grid and transfer-trip points
- Interconnect with automated demand response
- Operate as baseload and/or area backup

Community Asset Microgrid Targets

Mission Critical Facilities and Public Buildings

- Shelters
- Hospitals
- Town Halls
- Emergency Response
- Telecommunications backup power
- Fueling, wastewater, potable water supply

Businesses and business parks with significant employment presence

Controlled Islanding

- *Capability* to isolate a portion of the grid
- Protects line crews
- Employs vertical comprehensive planning with transfer trip scheme
- Enables utility to better serve its customers

Economics

Resource Benefits

- Use of high efficiency generation and renewable technology
- Improved reliability
- Reduced costs from electric service interruptions
- Job creation
- Community support
- Improved environmental performance
- Improved confidence
- Use of state businesses for manufacture and build out
- Executes state energy, environmental, and economic policy

Resource Costs

- Utility owned operated with vertical integration ROE 8% to 12.4%
- Shared cost of operation with customers

Business Analysis

Combined Heat and Power Financial Model with Recip. Eng. Technology
Connecticut Center for Advanced Technology, Inc.
Microgrid Example with Biogas
Based on June, 2012 rates

Payback in year 3	
NPV	$6,276,421
IRR	33.06%

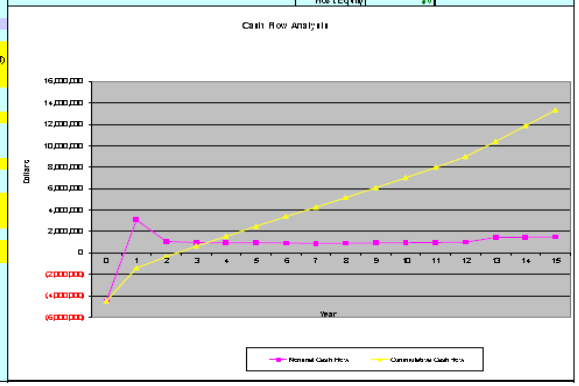
Recip. Eng.	Technology:
1,800	kW AC Peak Host Demand Capacity
93%	Host approximate Load Factor
14,664,240	kWhs Host Average Energy Demand
0%	Host Expected Return on Equity
-	mbtu/hr Average Host Heat Demand
1,800	kW AC Nameplate Capacity
1800	kW AC Average Capacity Recip. Engine Installation
93.00%	Capacity Factor
5,200	Average Heat Rate
134,511	mmbtu Heat Input Per Year Required
14,664,240	Recip. Engine Gen output is 100% of Host Requirement
4,251,200	mbtu/hr Average generated by Recip. Eng.
0%	Electricity Cost Discount to Customer (% vs Baseline Avoided)
0.82	Utility Total Avoided Energy Cost ($/kWh)
0.000	Generation Commodity Portion of Bill ($/kWh)
3.0%	Utility & Nat Gas & LFG Esc. Rate
3.0%	O&M Esc. Rate
$2.10	Biogas Input Fuel $/mmbtu
$0.00	Fuel Oil Cost $/mmbtu
$0.00	Propane Cost $/mmbtu
$0.00	Boiler Natural Gas and Fuel Oil Cost $/mmbtu
Y	Property Taxes (Y/N)
$30.00	Property Tax Mill rate
70%	Percentage Assessment
N	Tax Issues for Takes NPV of Depreciation Up Front (Y/N)
$450	Capital Grant ($/kW)
$40,000	Resc. Market Value De-Esc @ 2%
2.00	O&M ($/kWh)
2012	Year Installed (For MACRS Depreciation Schedule)
40.35%	Marginal Corporate Tax Rate
37.1%	Estimated Annualized System Efficiency
-	Waste Heat Captured Annually (MMBTUs)
8,760	Waste Heat Production Hours Annually
80.0%	CHP Heat Exchanger Efficiency
15	- Number of Years in the Analysis
GST	Host UI Electric Rate
Third Party Rate	

CL&P ☐
UI ☑ Non Profit ☐

Cost of Capital:	Percent	Rate	pre-tax
Debt	100.00%	7.00%	7.00%
Equity	0.00%	8.00%	0.00%
Weighted Capital Cost			7.00%

Finance Term - 12 Years
Depreciation - 6 Years

Capital Cost:		
Recip. Eng.	$1,770	per kW
Install Cost	$730	per kW
B/E Analysis		per kW
Total Cost	$2,500	per kW
Or	$4,500,000	Dollars
	0	
Subsidies & Tax	(1,260,000)	
Host Equity	$0	



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Host Current Total power Cost	Period 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Supplied by: UI															
Energy (Generation)	879,854	906,250	933,438	961,441	990,284	1,019,992	1,050,592	1,082,110	1,114,573	1,148,010	1,182,451	1,217,924	1,254,462	1,292,096	1,330,859
Total Delivery Charges	385,666	397,236	409,153	421,427	434,070	447,092	460,505	474,320	488,550	503,206	518,302	533,852	549,867	566,363	583,354
Thermal Requirement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Host Total Energy Cost	1,265,520	1,303,486	1,342,590	1,382,868	1,424,354	1,467,085	1,511,097	1,556,430	1,603,123	1,651,217	1,700,753	1,751,776	1,804,329	1,858,459	1,914,213
Host On-Site Generation Cost with Recip. Eng.															
Energy (Generation)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Delivery Charges	802	826	851	876	902	930	957	986	1,016	1,046	1,078	1,110	1,143	1,178	1,213
O&M	293,285	302,083	311,146	320,480	330,095	339,997	350,197	360,703	371,524	382,670	394,150	405,975	418,154	430,699	443,620
Property Taxes	94,600	97,335	100,255	103,263	106,361	109,651	112,838	116,223	119,710	123,301	127,000	130,810	134,734	138,776	142,940
Recip. Eng. Fuel Cost	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313	283,313
Electric Cost Discount for Customer at 0 Percent of Baseline	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Water Cost (Usage and Discharge)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thermal Cost	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Absorption Chiller Thermal Displacement	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sale of Renewable Energy Credits	(686,570)	(674,838)	(663,341)	(652,075)	(641,033)	(630,212)	(619,608)	(609,216)	(499,032)	(489,051)	(479,270)	(469,685)	(460,291)	(451,085)	(442,063)
Capacity Payments	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
State Capital Grant	(810,000)														
Tax Credits	(450,000)														
☑ Include Depreciation — Depreciation of Assets	(1,047,803)	279,414	(167,648)	(100,589)	(100,589)	(50,295)	-	-	-	-	-	-	-	-	-
Total OS Host Generation Cost	(2,222,472)	(170,695)	(35,429)	55,269	79,049	153,285	227,698	252,010	276,531	301,279	326,271	351,523	377,054	402,881	429,022
Finance Cost	407,922	407,922	407,922	407,922	407,922	407,922	407,922	407,922	407,922	407,922	407,922	407,922	-	-	-
Recovery of Equity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Return on Equity	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Savings/ (Cost)	3,080,070	1,066,258	970,093	919,677	937,383	905,878	875,477	896,498	918,669	942,015	966,560	992,330	1,427,275	1,455,578	1,485,191

IRR	33.06%
NPV	$6,276,421

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Summary

- Increased power reliability and security
- Increased public safety
- Improved business competitiveness
- Increased manufacturing and employment
- Catalyzes development of smart grid
- Improved vertical integration of grid assets
- Execution of energy, economic and environmental policy