Survey of DER/CHP Software

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UT-BATTELLE

Survey of DER/CHP Software

- Identify and summarize available software that evaluates or helps design DER/CHP applications for buildings, campuses, industry
- Survey does not address non-CHP building design or simulation software (e.g., Trane Trace, Carrier HAP, EnergyPlus)
- Survey does not include private or in-house tools (e.g., FEMP spreadsheet screening analyses)
- Packages must include economic as well as technical elements
- Categorize DER/CHP software packages by:
  - Intended use
  - Type of calculations
  - Analysis duration and time step
  - DER/CHP technologies
  - Data libraries
  - Types of CHP processes
  - Cost and availability

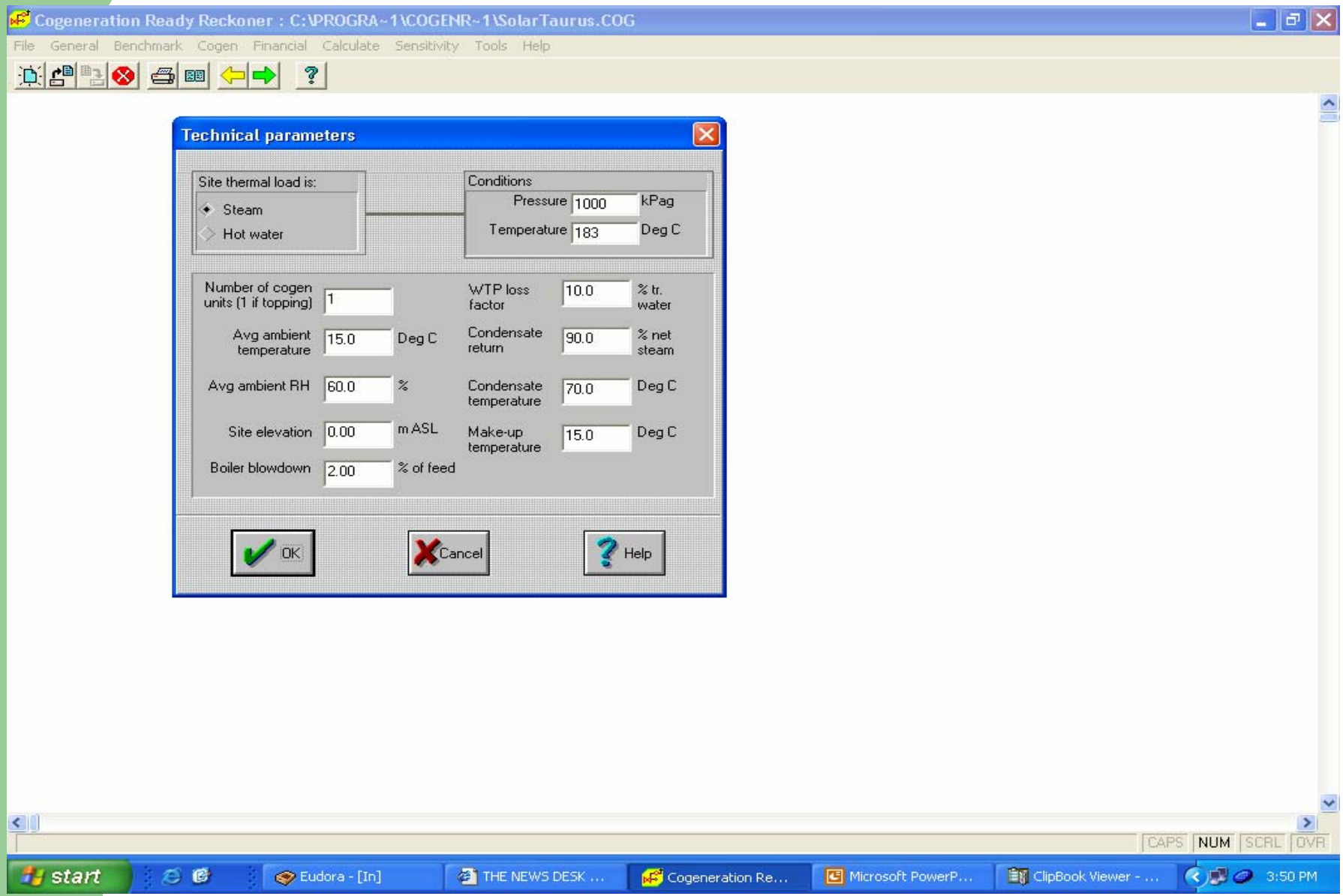
Software Packages Evaluated

- Cogeneration Ready Reckoner
- RECIPRO
- Plant Design Expert (PDE)
- Building Energy Analyzer
- D-Gen Pro
- BCHP Screening Tool
- Heatmap CHP
- GT Pro
- SOAPP-CT.25

Cogeneration Ready Reckoner

- Developed initially for Australian Department of Industry, Science, and Resources by Sinclair Knight Merz
- Primary use: Screening of industrial cogeneration applications
- Provides baseline comparison (grid electricity and separate steam boiler)
- Equipment data library: GT and recip engine gen sets
- CHP applications: Process steam, hot water, chilled water
- Analysis duration/time step: 20 years; up to monthly
- Economic analyses: cash flow, payback, NPV, IRR
- Cost: Free (download from http://www.eere.energy.gov/der/chp/chp-eval2.html

Input to Ready Reckoner Is Through Pop-Up Windows



Ready Reckoner Output Is Tabular – On Screen, Printer, or File

Cogeneration Ready Reckoner : C:\PROGRA~1\COGENR~1\SolarTaurus.COG

File General Benchmark Cogen Financial Calculate Sensitivity Tools Help

Approx date:		Jun-02	Jun-03	Jun-04	Jun-05	Jun-06	Jun-07	Jun-08	Jun-09	Jun-10	Jun-11	Jun-12	Jun-13	Jun-14	Jun-15	Jun-16
Year:		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Cogen case annual flows																
WHB steam	kT/a		64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6
Aux boiler steam	kT/a		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Gross steam	kT/a		64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6	64.6
Deaeration steam	kT/a		4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58
Net steam	kT/a		60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Gross Gen. Electricity	GWh		29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
Process electricity usage	GWh		29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
Parasitic electricity	GWh		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Export Electricity	GWh		0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036	0.036
Import Electricity	GWh		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Import Elec. Demand	MW		4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83
Cogen Fuel usage	TJ/a HHV		397	397	397	397	397	397	397	397	397	397	397	397	397	397
Aux Boiler Fuel usage	TJ/a HHV		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Total Fuel usage	TJ/a HHV		397	397	397	397	397	397	397	397	397	397	397	397	397	397
Fuel demand	GJ/h HHV		66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2	66.2
Ash	kT/a		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
CO2 emissions	kT/a		20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6
Net electrical efficiency	% HHV		26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3	26.3
Net elec effic (f-to-p)	% HHV		47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6
Net thermal efficiency	% HHV		64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3
Condensate returned	kT/a		54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
Treated water	kT/a		7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32	7.32
Raw water	kT/a		8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05	8.05
WTP loss	kT/a		0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732	0.732
Blowdown	kT/a		1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32	1.32
Sewer	kT/a		2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05	2.05

CAPS NUM SCRL OVR

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Ready Reckoner Output

Separately for baseline (benchmark) and DER case:

- Hourly and annual mass flows (e.g., steam, water, CO_2)
- Hourly and annual fuel flows
- Hourly and annual electricity usage
- Annual operating, capital, and tax-related cash flows

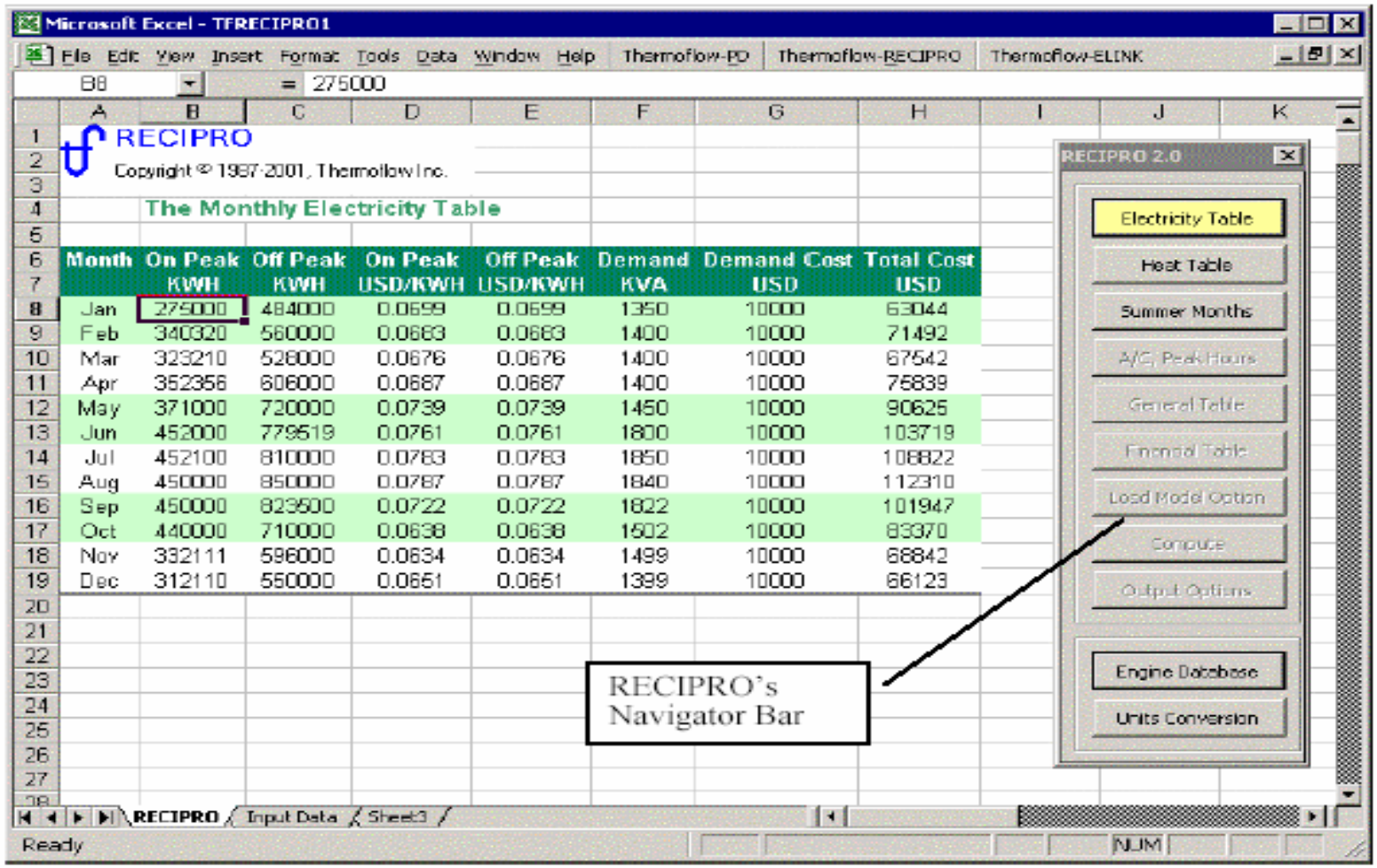
In comparison of baseline to DER case:

- Differential operating, capital, and tax-related cash flows
- Net present value (NPV)
- Internal rate of return (IRR)
- Simple payback
- NPV sensitivity charts for fuel and electricity prices, capital cost, discount rate

RECIPRO

- Developed by Thermoflow, Inc.
- Primary use: Screening of small commercial/industrial cogeneration applications
- Add-in module to Excel 2000 spreadsheet software
- Provides baseline comparison (grid electricity and separate boiler)
- Equipment data library: Reciprocating engine gen sets
- CHP applications: Hot water, chilled water
- Analysis duration/time step: unlimited; monthly (with single daily load curve per month)
- Economic analyses: cash flow, NPV
- Cost: $1,500. (http://www.thermoflow.com/)

RECIPRO Input/Output Is On Excel Spreadsheet



Month	On Peak KWH	Off Peak KWH	On Peak USD/KWH	Off Peak USD/KWH	Demand KVA	Demand Cost USD	Total Cost USD
Jan	275000	484000	0.0699	0.0699	1350	10000	63044
Feb	340320	560000	0.0683	0.0683	1400	10000	71492
Mar	323210	526000	0.0676	0.0676	1400	10000	67542
Apr	352356	606000	0.0687	0.0687	1400	10000	75839
May	371000	720000	0.0739	0.0739	1450	10000	90625
Jun	452000	779519	0.0761	0.0761	1800	10000	103719
Jul	452100	810000	0.0783	0.0783	1850	10000	108822
Aug	450000	850000	0.0787	0.0787	1840	10000	112310
Sep	450000	823500	0.0722	0.0722	1822	10000	101947
Oct	440000	710000	0.0638	0.0638	1502	10000	83370
Nov	332111	596000	0.0634	0.0634	1499	10000	68842
Dec	312110	550000	0.0651	0.0651	1399	10000	66123

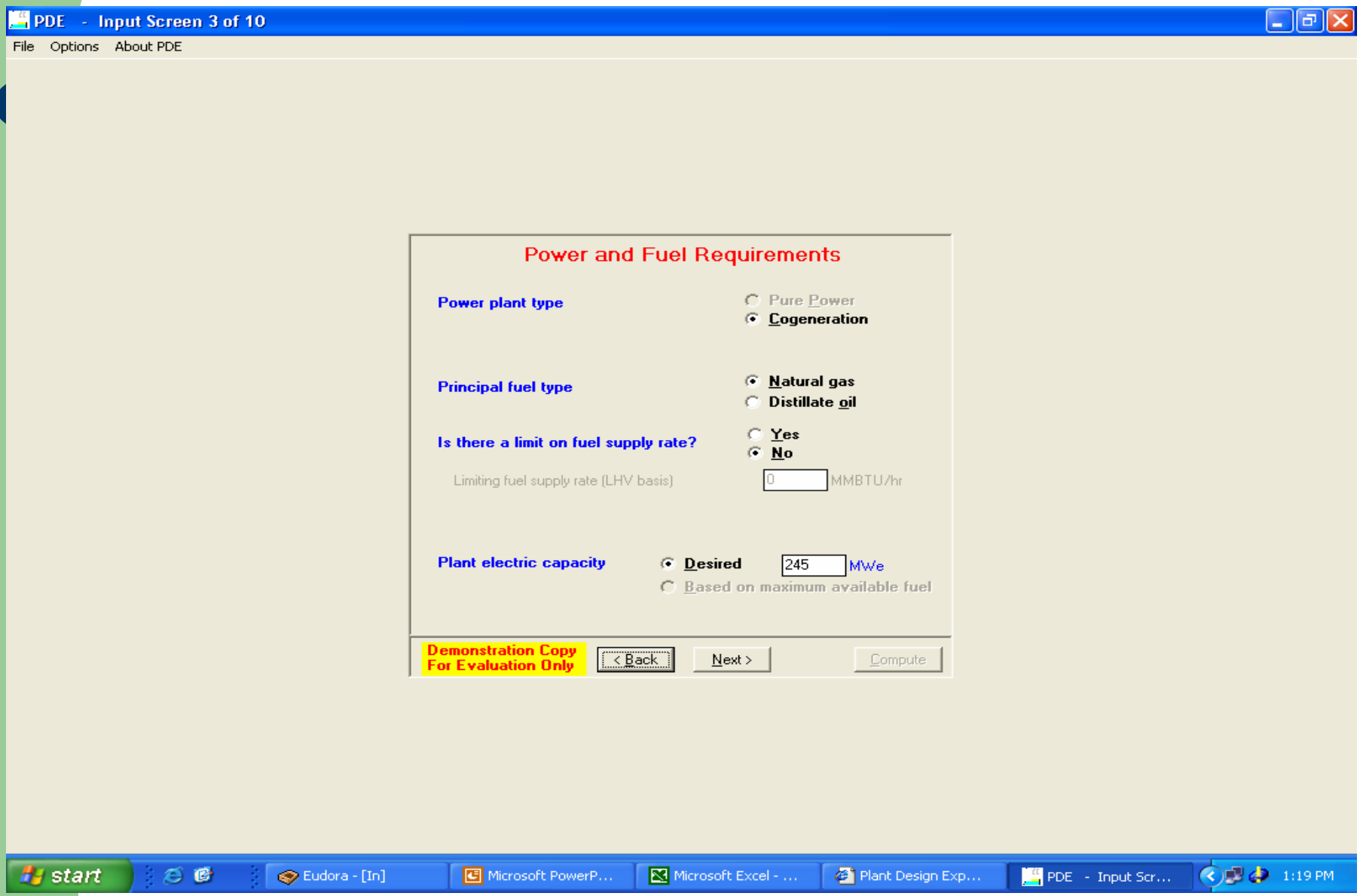
RECIPRO Output

- Fuel flows
- Electricity production/consumption
- Heat production/consumption
- Monthly operating, capital, and tax-related cash flows for reference year

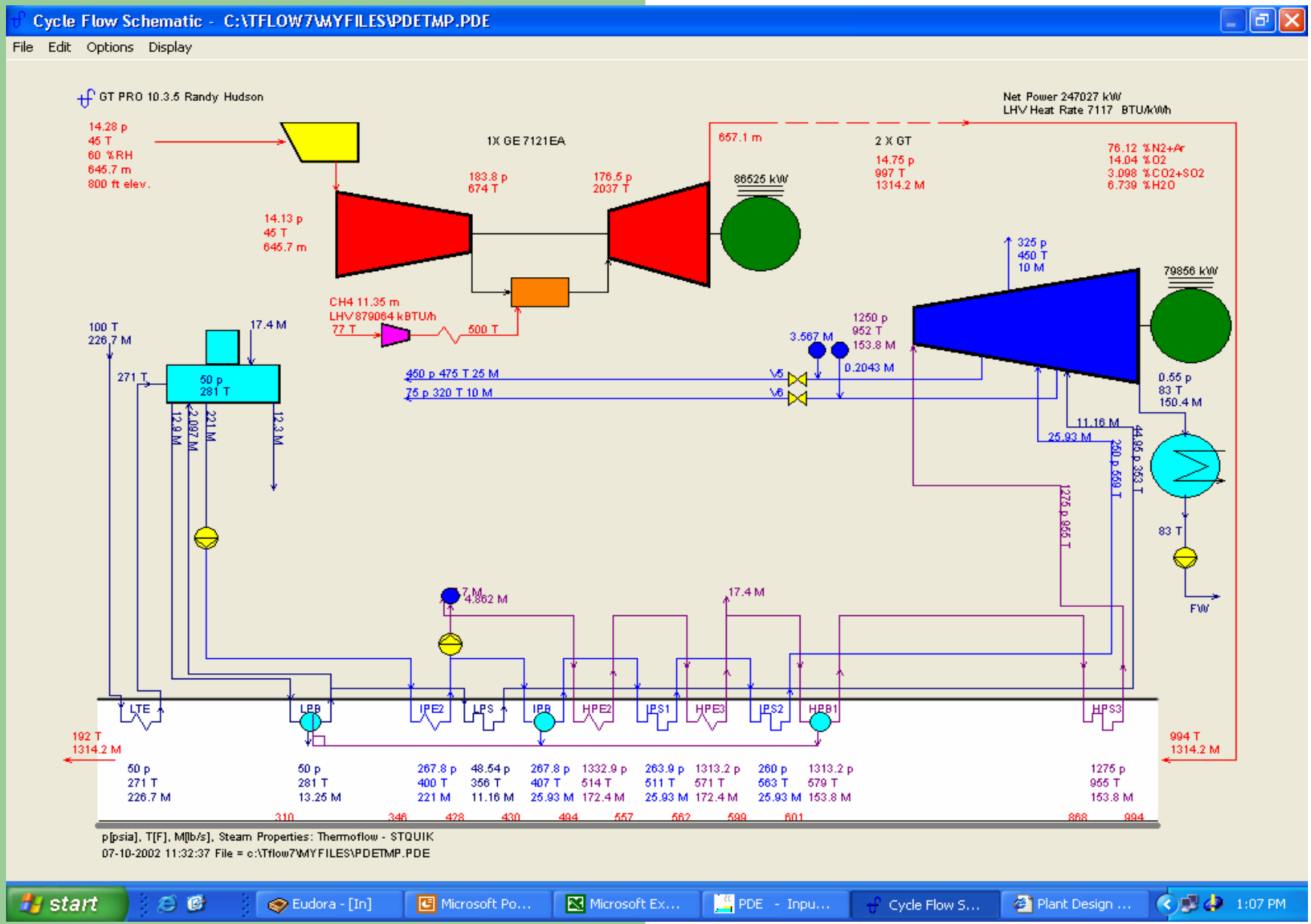
Plant Design Expert (PDE)

- Developed by Thermoflow, Inc.
- Primary use: Preliminary design/screening of industrial cogeneration applications using gas turbines
- Provides baseline comparison (grid electricity and separate boiler)
- *Very* limited user input; most selections made by program
- Equipment data library: Gas turbine performance data
- CHP applications: Process steam, hot water
- Analysis duration/time step: unknown; annual
- Economic analyses: Simplistic IRR only
- Cost: $3,000. (http://www.thermoflow.com/)
- Demo CD available

PDE Input Is Through On-Screen Windows



PDE Provides Text and Graphical Output



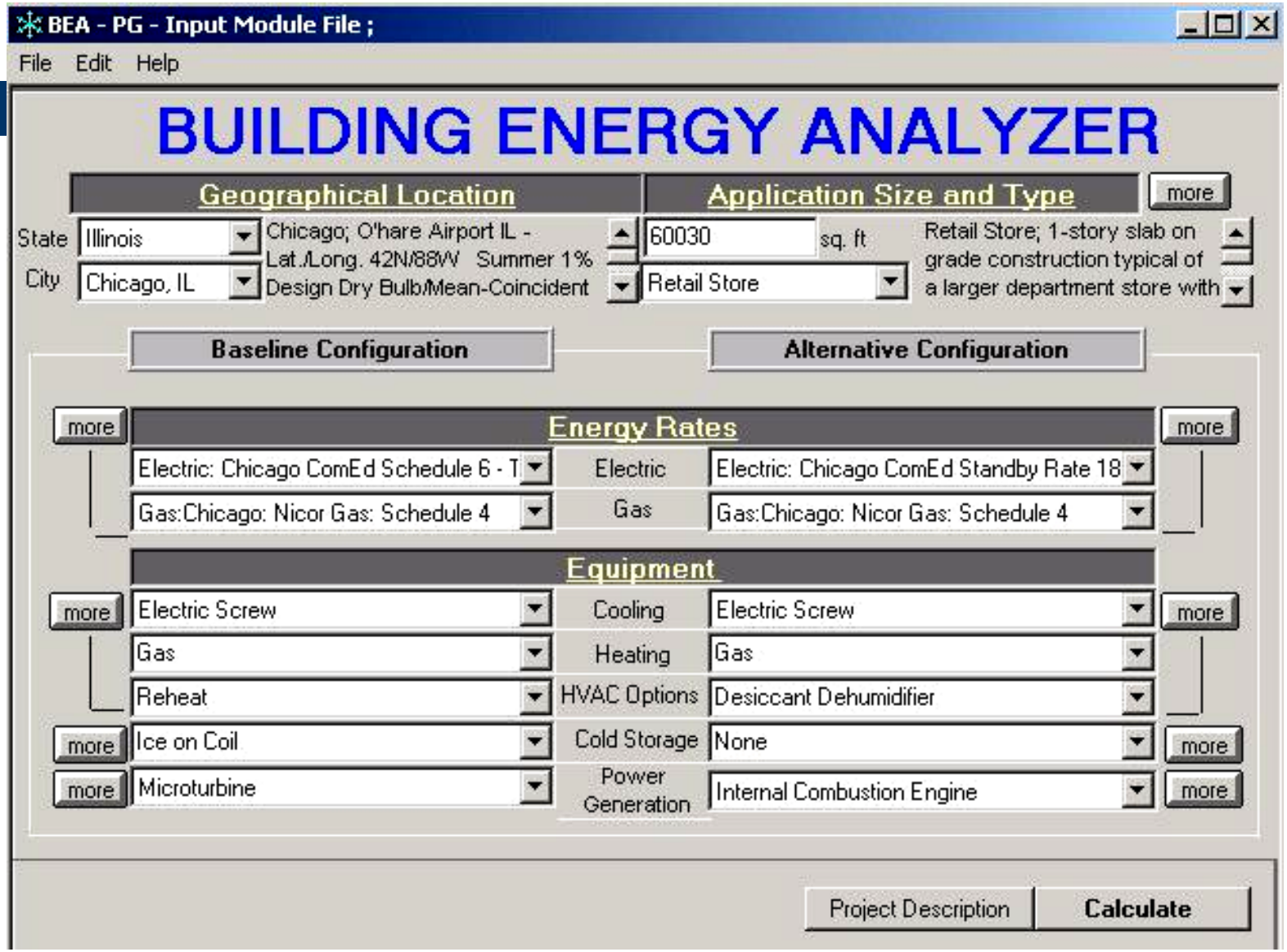
PDE Output

- Preliminary conceptual plant design
- Heat balance
- Power and energy output capacities
- Internal rate of return based on user-supplied cost data

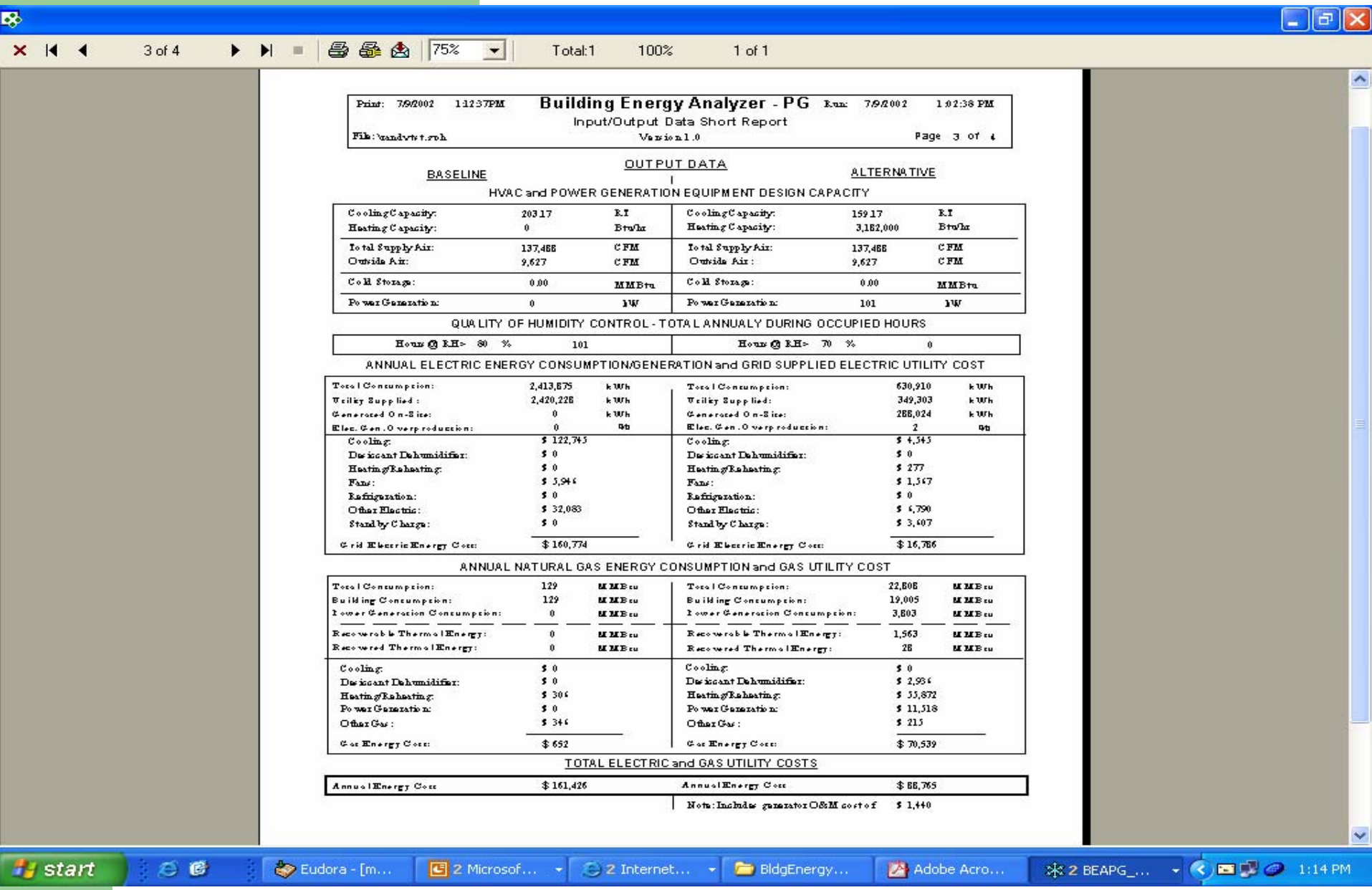
Building Energy Analyzer (BEA)

- Developed by InterEnergy Software (Gas Technology Institute)
- Primary use: Screening of CHP applications in commercial buildings using DOE-2 simulation engine
- Provides grid-based baseline comparison
- Data libraries: 8 types of generation equipment, 17 types of HVAC equipment, utility rates, weather, 15 specific building types (e.g., hospital, office, hotel, school, retail)
- CHP applications: Hot water, space heating/cooling, thermal storage, dehumidification
- Analysis duration/time step: maximum of 35 years; monthly
- Economic analyses: cash flow, payback, IRR
- Cost: $800 (http://www.interenergysoftware.com/)

Input to BEA Is Through On-Screen Windows



BEA Output Is Through On-screen or Printed Tables



3 of 4 | 75% | Total:1 | 100% | 1 of 1

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Input/Output Data Short Report

File: \randv\vt.svb Version 1.0 Page 3 of 4

OUTPUT DATA

BASELINE			ALTERNATIVE		
HVAC and POWER GENERATION EQUIPMENT DESIGN CAPACITY					
Cooling Capacity:	203.17	E.I	Cooling Capacity:	159.17	E.I
Heating Capacity:	0	Btu/hr	Heating Capacity:	3,182,000	Btu/hr
Total Supply Air:	137,488	CFM	Total Supply Air:	137,488	CFM
Outside Air:	9,627	CFM	Outside Air:	9,627	CFM
Cold Storage:	0.00	MMBtu	Cold Storage:	0.00	MMBtu
Power Generation:	0	kW	Power Generation:	101	kW
QUALITY OF HUMIDITY CONTROL - TOTAL ANNUALY DURING OCCUPIED HOURS					
Hours @ RH> 80 %	101		Hours @ RH> 70 %	0	
ANNUAL ELECTRIC ENERGY CONSUMPTION/GENERATION and GRID SUPPLIED ELECTRIC UTILITY COST					
Total Consumption:	2,413,875	kWh	Total Consumption:	630,910	kWh
Utility Supplied:	2,420,228	kWh	Utility Supplied:	349,303	kWh
Generated On-Site:	0	kWh	Generated On-Site:	288,024	kWh
Elec. Gen. Overproduction:	0	%	Elec. Gen. Overproduction:	2	%
Cooling:	$ 122,745		Cooling:	$ 4,545	
Desiccant Dehumidifier:	$ 0		Desiccant Dehumidifier:	$ 0	
Heating/Reheating:	$ 0		Heating/Reheating:	$ 277	
Fans:	$ 5,946		Fans:	$ 1,567	
Refrigeration:	$ 0		Refrigeration:	$ 0	
Other Electric:	$ 32,083		Other Electric:	$ 6,790	
Standby Charge:	$ 0		Standby Charge:	$ 3,607	
Grid Electric Energy Cost:	$ 160,774		Grid Electric Energy Cost:	$ 16,786	
ANNUAL NATURAL GAS ENERGY CONSUMPTION and GAS UTILITY COST					
Total Consumption:	129	MMBtu	Total Consumption:	22,808	MMBtu
Building Consumption:	129	MMBtu	Building Consumption:	19,005	MMBtu
Power Generation Consumption:	0	MMBtu	Power Generation Consumption:	3,803	MMBtu
Recoverable Thermal Energy:	0	MMBtu	Recoverable Thermal Energy:	1,563	MMBtu
Recovered Thermal Energy:	0	MMBtu	Recovered Thermal Energy:	28	MMBtu
Cooling:	$ 0		Cooling:	$ 0	
Desiccant Dehumidifier:	$ 0		Desiccant Dehumidifier:	$ 2,936	
Heating/Reheating:	$ 306		Heating/Reheating:	$ 55,872	
Power Generation:	$ 0		Power Generation:	$ 11,518	
Other Gas:	$ 346		Other Gas:	$ 215	
Gas Energy Cost:	$ 652		Gas Energy Cost:	$ 70,539	
TOTAL ELECTRIC and GAS UTILITY COSTS					
Annual Energy Cost	$ 161,426		Annual Energy Cost	$ 88,765	
			Note: Includes generator O&M cost of	$ 1,440	

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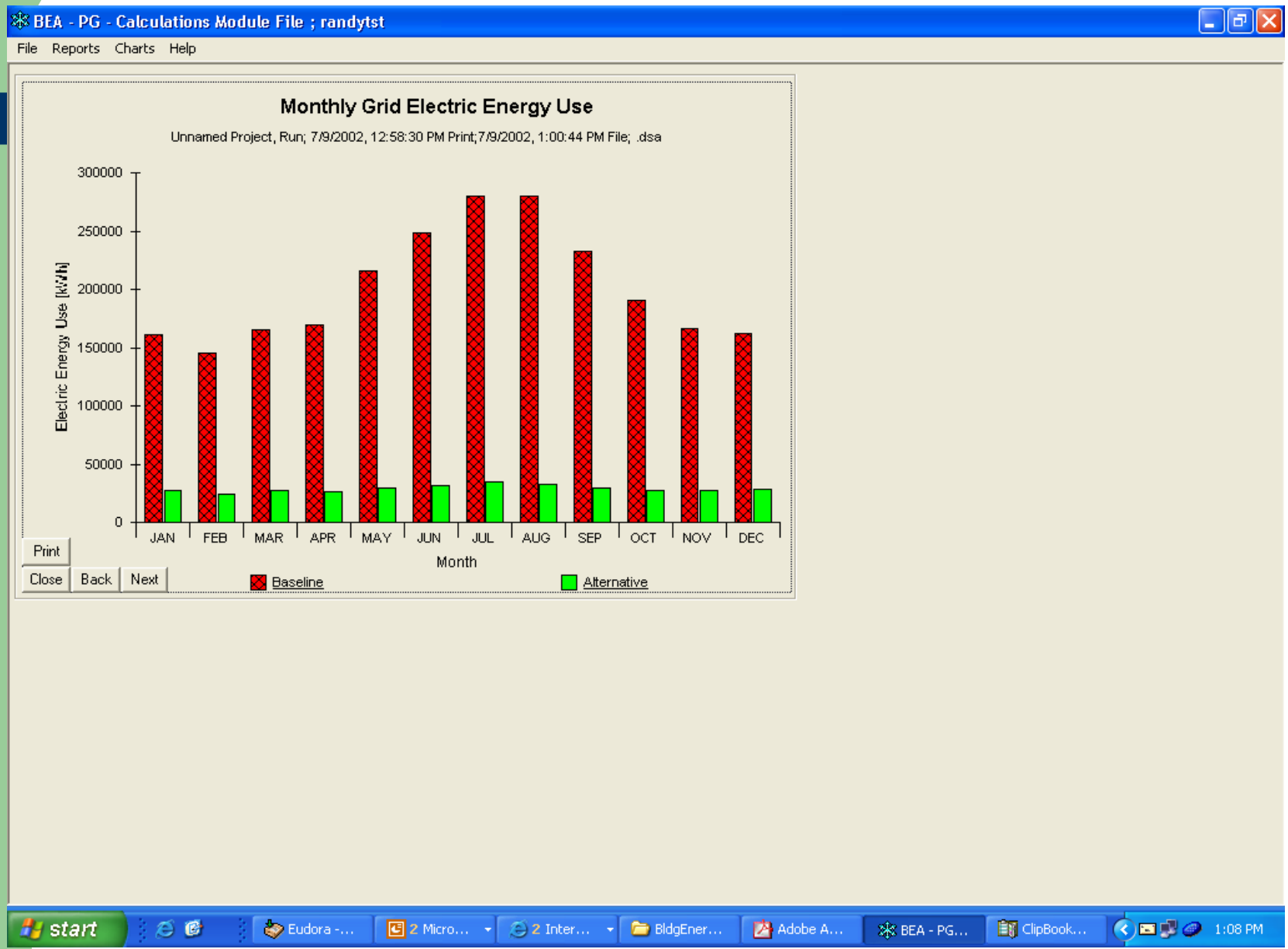


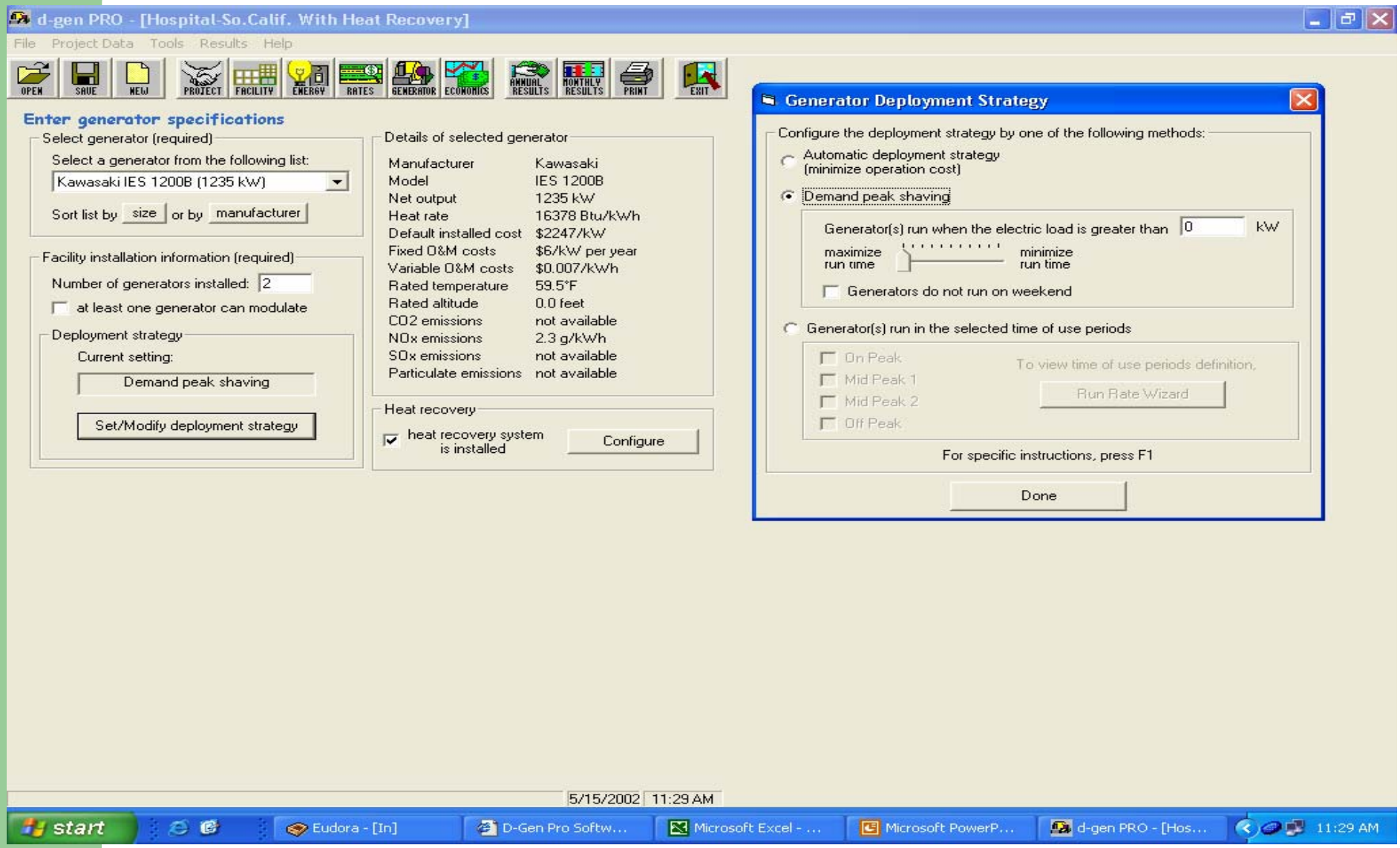
Building Energy Analyzer Output

- Tabular reports
  - Two levels of detail
  - Baseline and alternative results on annual or monthly basis
- Nine charts
  - Monthly and annual energy use and cost of electricity and gas
  - Humidity levels
  - Power generation heat recovery utilization

D-Gen Pro

- Developed by Architectural Energy Corporation and Gas Technology Institute
- Primary use: Preliminary screening of CHP heating applications in commercial buildings
- Provides baseline comparison (grid electricity and separate steam boiler)
- Data libraries: Generation equipment, HVAC equipment, utility rates, climate, 14 specific building types (e.g., hospital, office, hotel, apartment, school, retail)
- CHP applications: Hot water, space heating (no cooling options)
- Analysis duration/time step: unlimited; monthly
- Economic analyses: payback, lifecycle, IRR
- Cost: $695 (http://www.interenergysoftware.com/)

Input to D-Gen Pro Is Through Pop-Up Windows



D-Gen Pro Output Is Through On-screen Windows and Printed Reports

View Full Report

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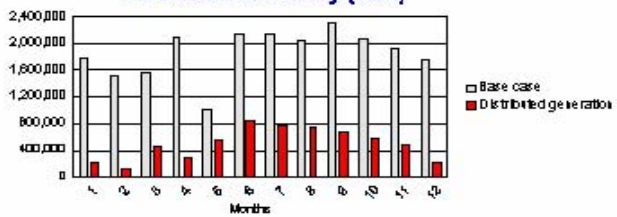
d-gen PRO

d-gen PRO version 3.09
Hospital-So.Calif. With Heat Recovery
Date: 6/28/2002

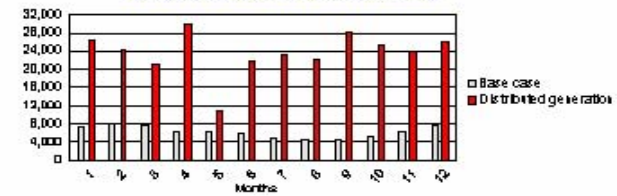
ENERGY CONSUMPTION SUMMARY

	Base case		Distributed generation case	
Month	Electricity consumption (kWh)	Natural gas consumption (MMBtu)	Electricity consumption (kWh)	Natural gas consumption (MMBtu)
Jan	1,783,081	7,559	208,706	26,513
Feb	1,621,179	8,141	122,813	24,325
Mar	1,554,119	7,849	453,048	21,034
Apr	2,083,680	6,501	285,491	29,958
May	1,027,621	6,264	547,414	10,788
Jun	2,134,621	5,911	845,272	22,070
Jul	2,153,247	4,843	771,951	23,411
Aug	2,060,911	4,649	747,761	22,274
Sep	2,327,130	4,576	654,988	28,132
Oct	2,071,709	5,289	575,262	25,221
Nov	1,914,974	6,496	485,935	24,091
Dec	1,758,240	7,704	210,060	26,214
Total	22,390,511	75,782	5,918,291	284,030

Purchased Electricity (kWh)



Purchased Natural Gas (MMBtu)



d-gen PRO © 1998-2000 G.P.

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D-Gen Pro Output

Separately for baseline (benchmark) and DER case:

- Monthly and annual fuel flows
- Monthly and annual electricity usage
- Monthly and annual energy costs

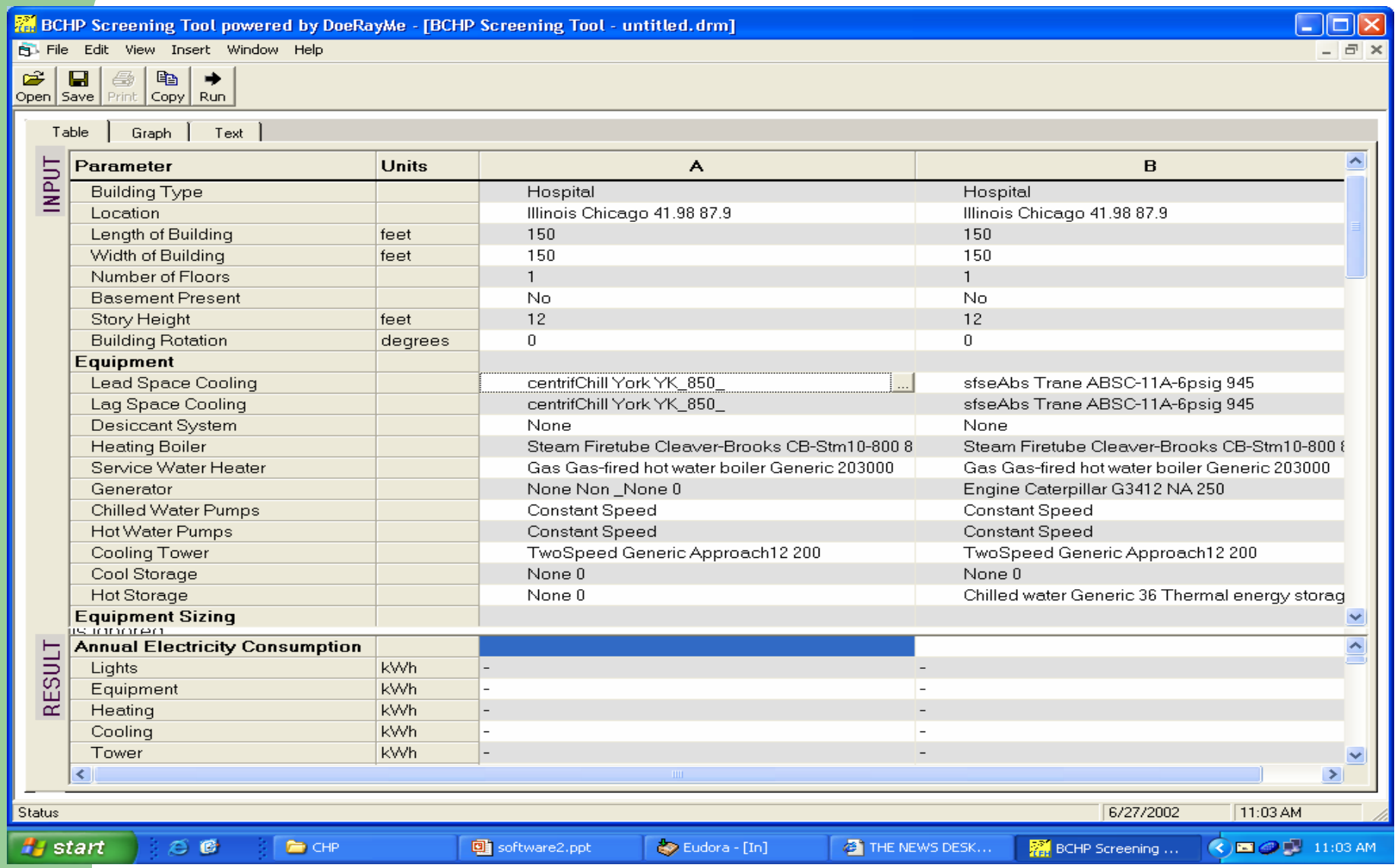
In comparison of baseline to DER case:

- Waste heat utilization summary
- Internal rate of return (IRR)
- Simple payback
- Lifecycle savings

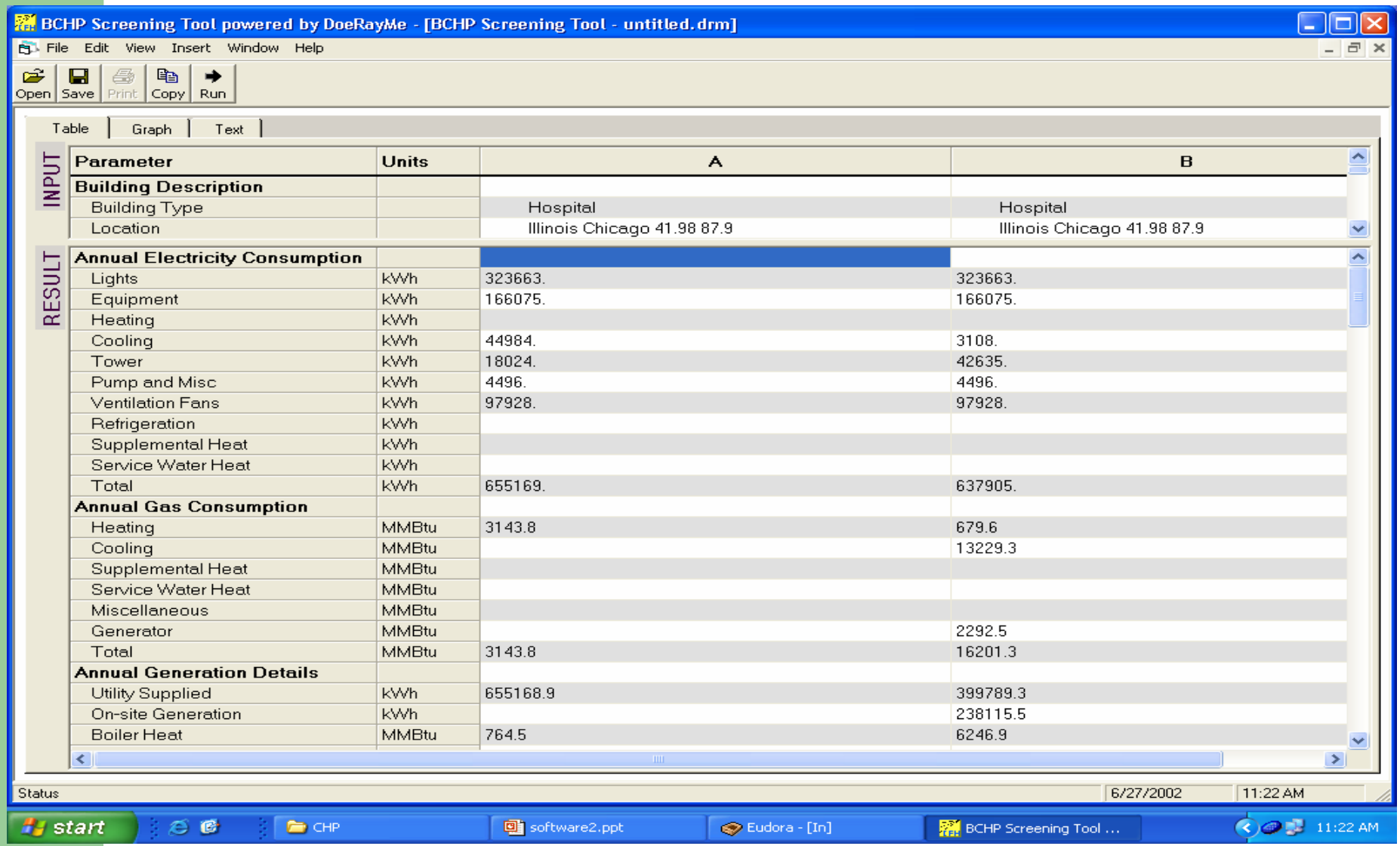
BCHP Screening Tool

- Under development by DOE/ORNL.
- Primary use: Screening of CHP applications in commercial buildings using DOE-2 simulation engine
- Data libraries: Generation equipment, HVAC equipment, utility rates, weather, 14 specific building types (e.g., hospital, office, hotel, school, retail)
- CHP applications: Hot water, chilled water, space heating
- Analysis duration/time step: 1 year; monthly
- Economic analyses: not available at this time
- Cost: TBD (currently in beta test)

Input to BCHP Screening Tool Is Through On-screen Spreadsheet



BCHP Screening Tool Output Is Through On-screen Spreadsheet



Parameter	Units	A	B
Building Description			
Building Type		Hospital	Hospital
Location		Illinois Chicago 41.98 87.9	Illinois Chicago 41.98 87.9
Annual Electricity Consumption			
Lights	kWh	323663.	323663.
Equipment	kWh	166075.	166075.
Heating	kWh		
Cooling	kWh	44984.	3108.
Tower	kWh	18024.	42635.
Pump and Misc	kWh	4496.	4496.
Ventilation Fans	kWh	97928.	97928.
Refrigeration	kWh		
Supplemental Heat	kWh		
Service Water Heat	kWh		
Total	kWh	655169.	637905.
Annual Gas Consumption			
Heating	MMBtu	3143.8	679.6
Cooling	MMBtu		13229.3
Supplemental Heat	MMBtu		
Service Water Heat	MMBtu		
Miscellaneous	MMBtu		
Generator	MMBtu		2292.5
Total	MMBtu	3143.8	16201.3
Annual Generation Details			
Utility Supplied	kWh	655168.9	399789.3
On-site Generation	kWh		238115.5
Boiler Heat	MMBtu	764.5	6246.9

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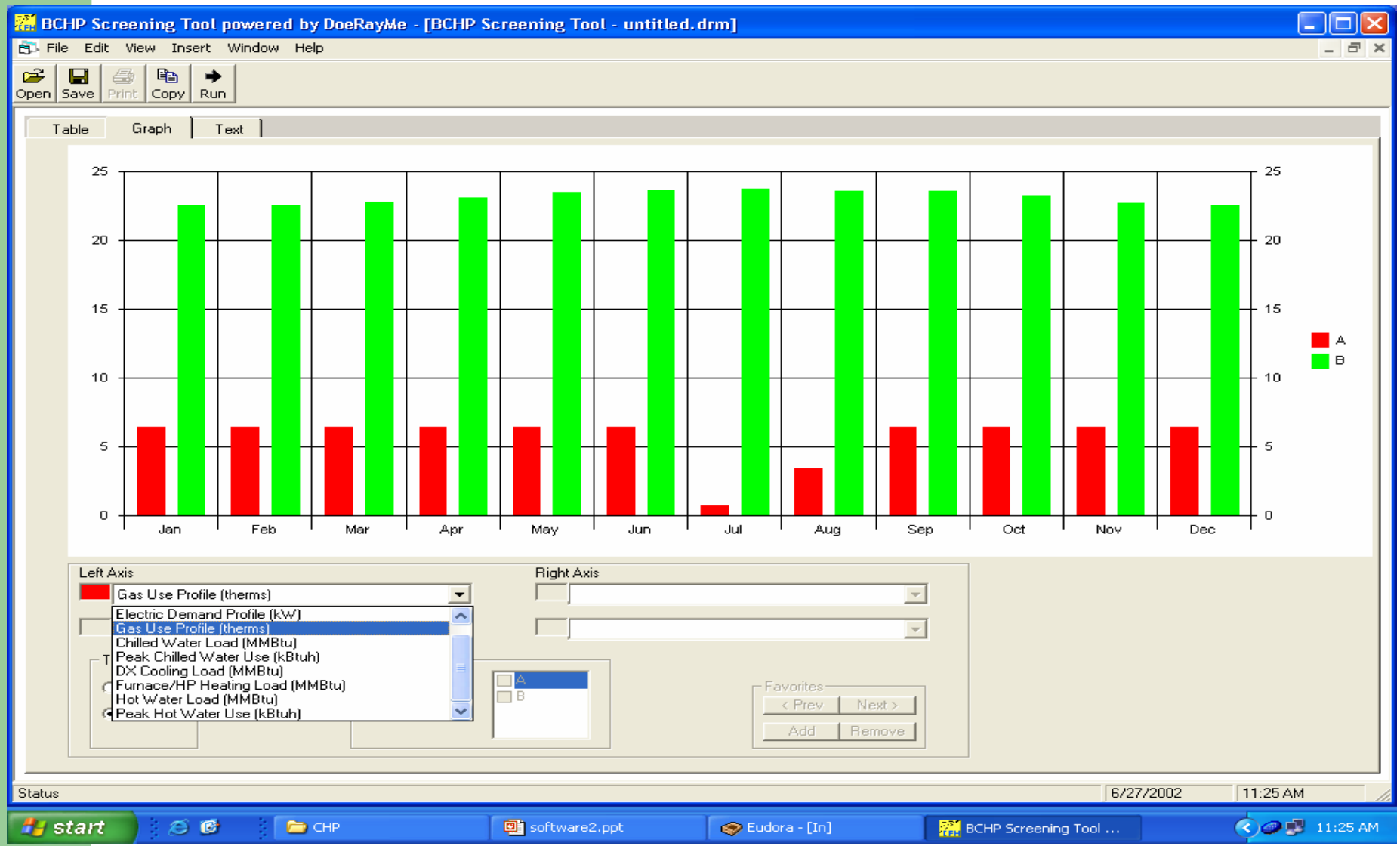


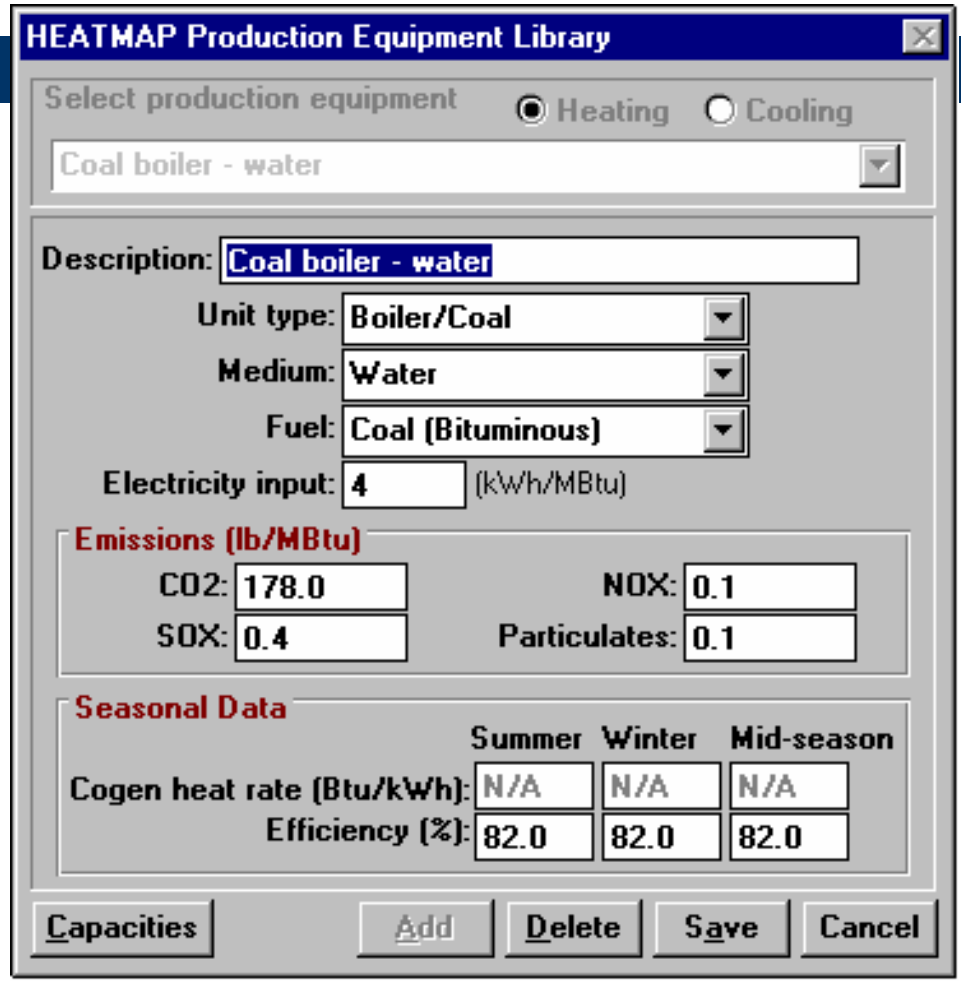
BCHP Screening Tool Output

- Annual and monthly electricity and gas demand and consumption
- Building energy loads
- Economic analysis results not available at this time - under development

HeatMap CHP

- Developed by Washington State University Cooperative Extension Energy Program (formerly Washington State Energy Office)
- Primary use: Detailed 3-D design simulation of proposed and existing CHP systems using DOE-2 simulation engine
- Provides baseline comparison (existing system)
- Data libraries: weather, building loads, production equipment, fuels, piping
- CHP applications: Process steam, hot water, chilled water, thermal storage
- Analysis duration/time step: 1 year; hourly (8,760 hours)
- Economic analyses: cash flow, revenue requirement, payback
- Cost: $4,000 (http://www.energy.wsu.edu/software/HEATMAP/)
- Requires separate installation of AutoCad software (approx. $3,000)
- No free trial or demo versions

Input to HeatMap CHP Is Through Pop-Up Windows



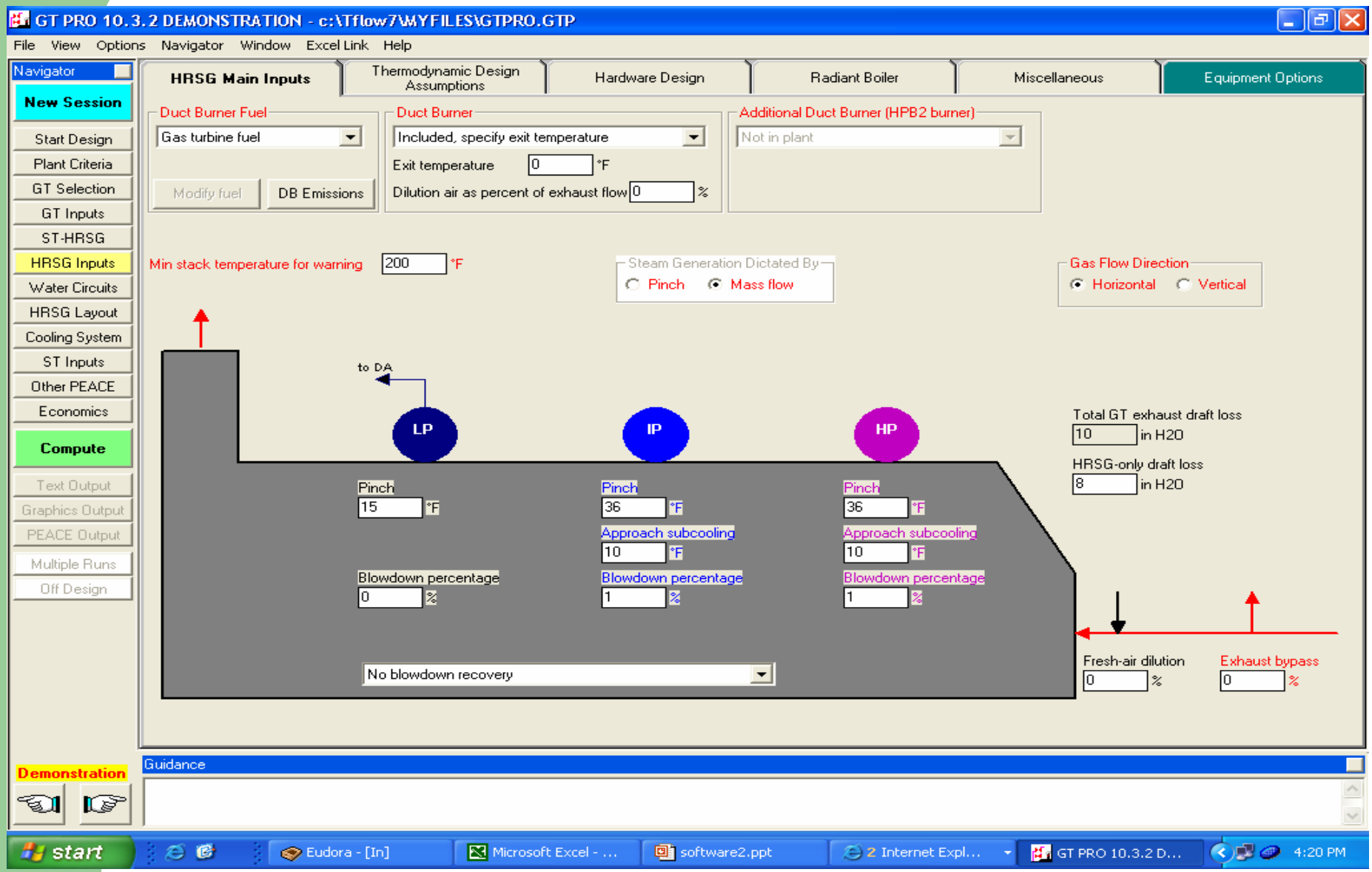
HeatMap CHP Output

- Estimated annual and peak consumer loads
- Annual fuel use and cost
- Capacity & cost of energy plant
- Size & cost of distribution system
- Distribution system flow, temperature, pressure, and heat transfer
- Cost of energy
- Cash flow and revenue requirements
- Annual emissions

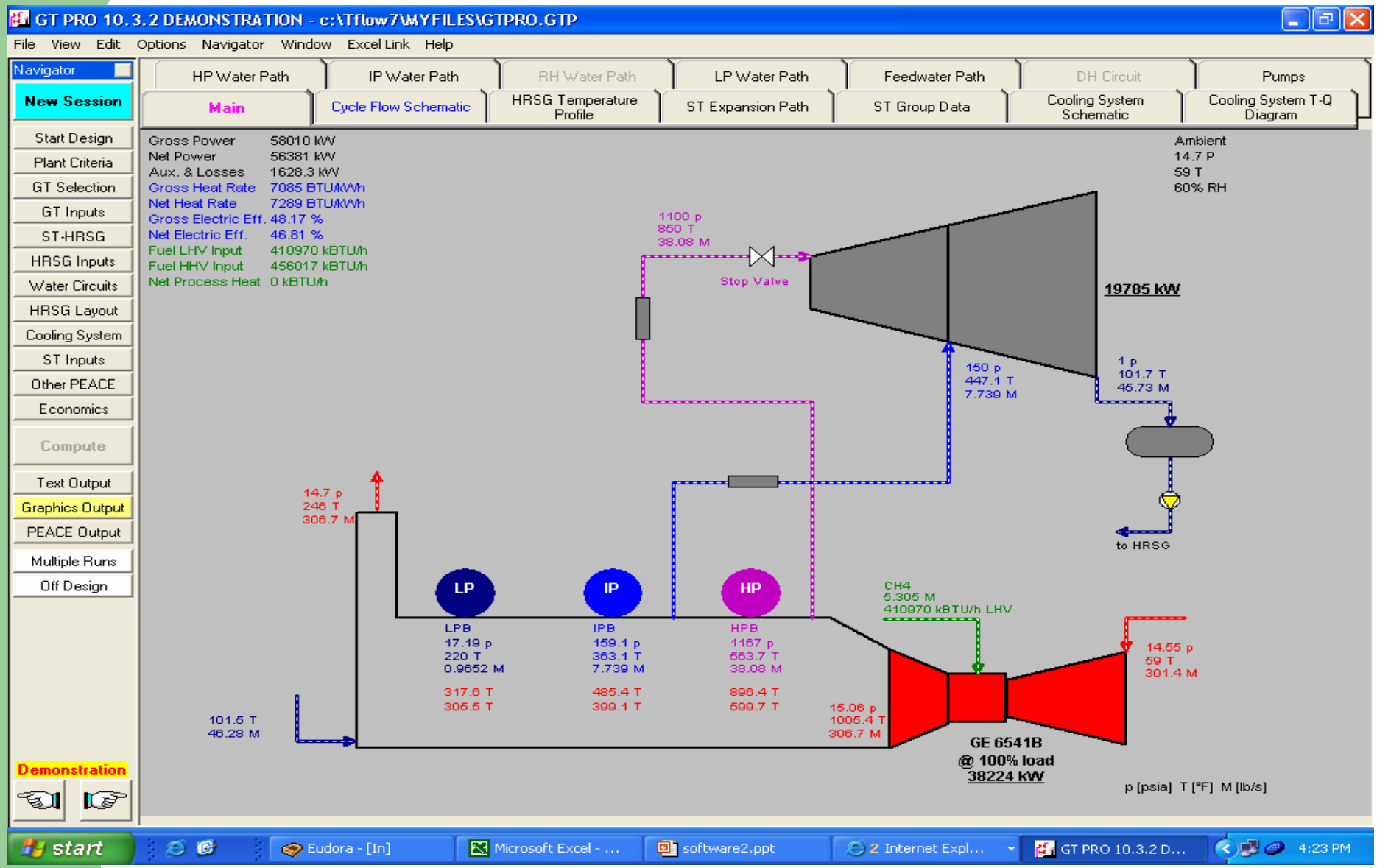
GT Pro

- Developed by Thermoflow, Inc.
- Primary use: **Detailed** design of industrial gas turbine applications with/without HRSG and/or combined cycle
- Does not provide baseline comparison (e.g., existing utility system)
- Data libraries: Gas turbines only
- CHP applications: Process steam
- Analysis duration/time step: between 8 and 40 years; annual
- Economic analyses: cash flow, payback, NPV, IRR
- Cost: $7,000 (http://www.thermoflow.com/)
- Demo version available on CD

Input to GT Pro Is Through On-Screen Windows



GT Pro Provides Detailed Text and Graphical Output Through On-screen Windows and Printed Reports



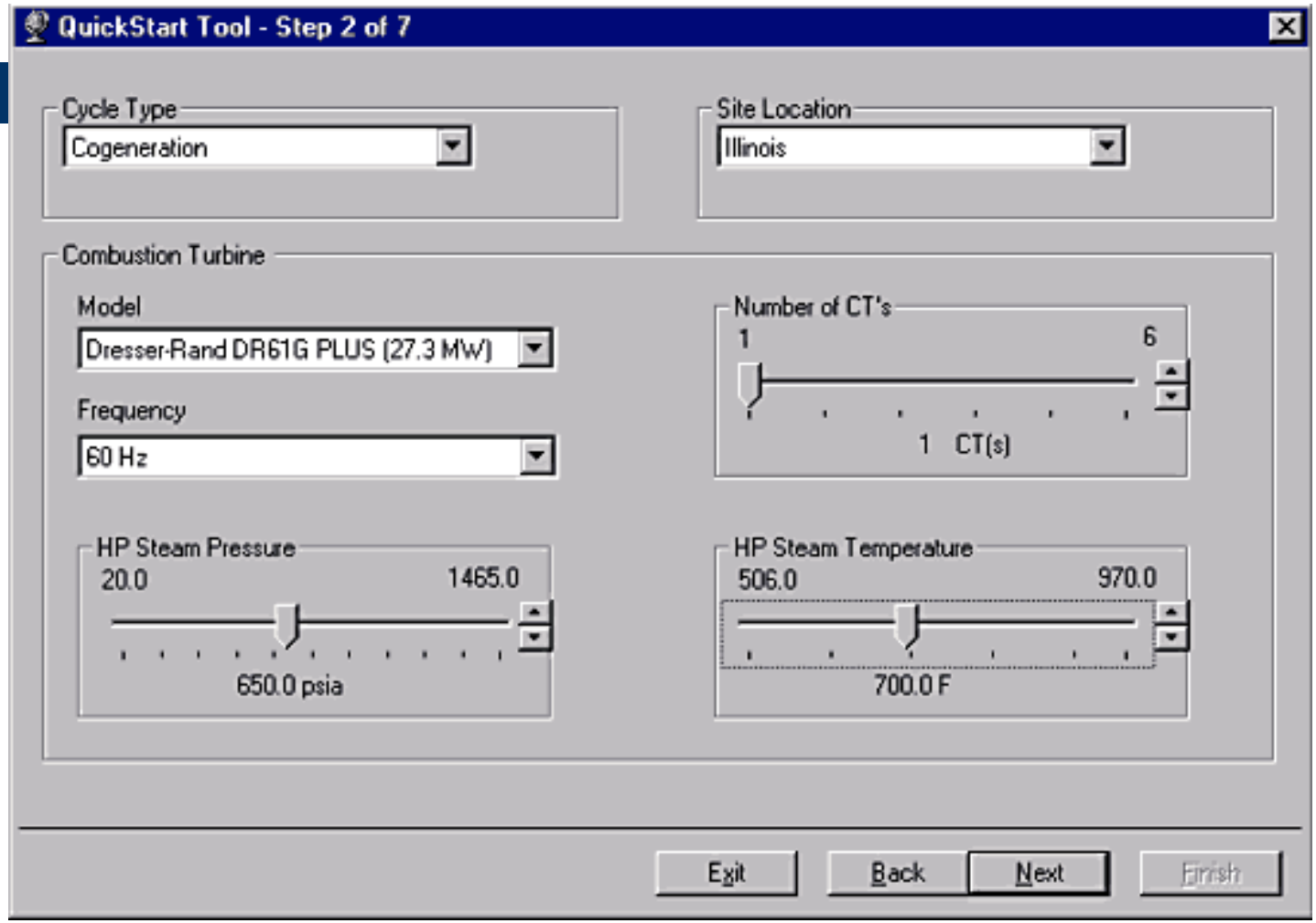
GT Pro Output

- ***Voluminous*** text and graphic output to screen or printer
- Output includes:
  - design and operation parameters
  - heat and mass balances
  - project economics
  - preliminary engineering details

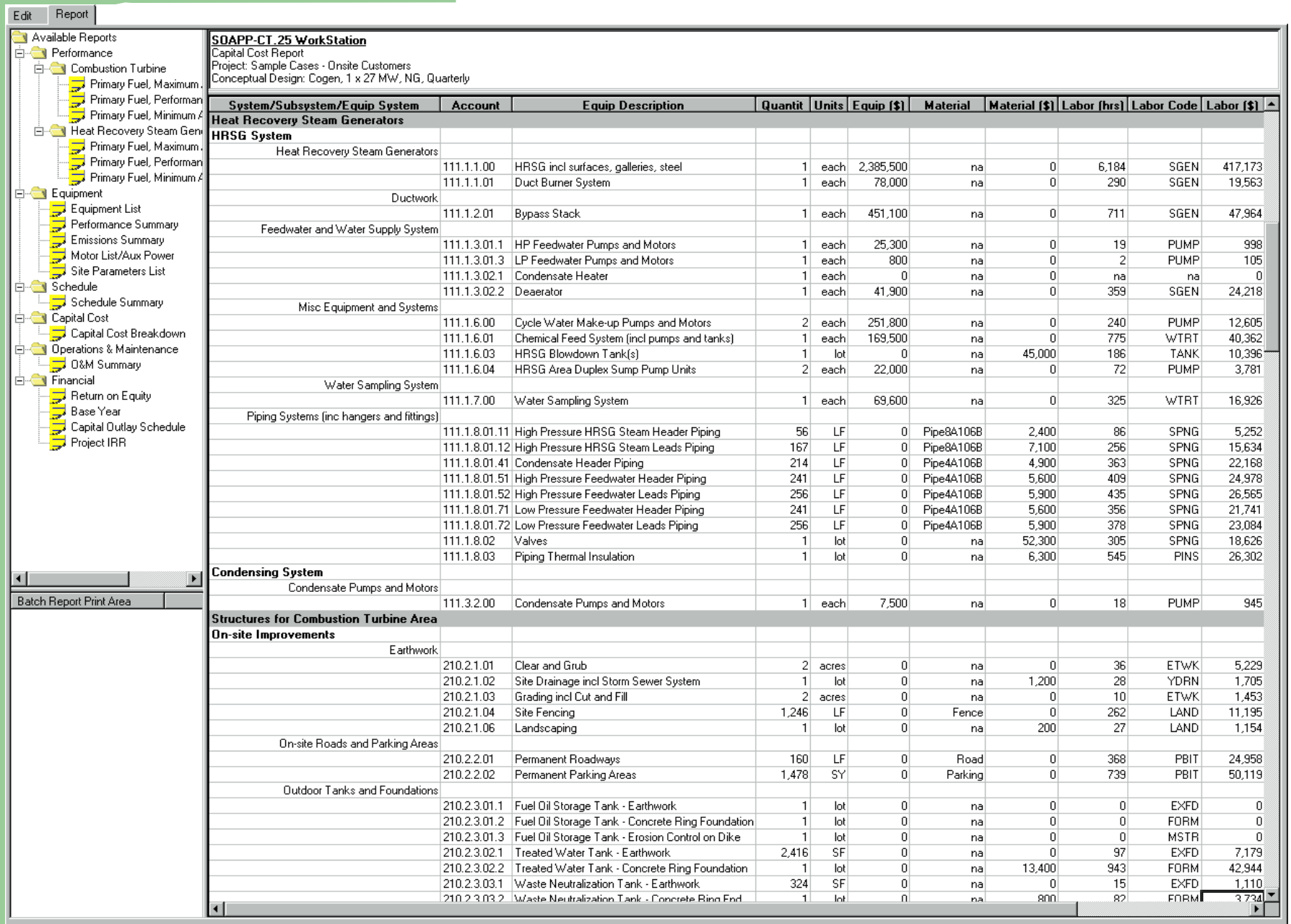
SOAPP-CT.25

- Developed by Electric Power Research Institute (EPRI)
- Primary use: Conceptual design of industrial gas turbine applications with/without HRSG
- Provides baseline comparison in the form of avoided cost
- Data libraries: Gas turbines, HRSG
- CHP applications: Process steam
- Analysis duration/time step: up to 40 years; up to monthly
- Economic analyses: cash flow, payback, NPV, IRR
- Cost: $7,500 (http://www.soapp.com/soapp/dg/)
- No free trial or demo versions

Input to SOAPP-CT.25 Is Through On-Screen Windows



SOAPP-CT.25 Provides Detailed Text Output Through On-screen Windows and Printed Reports



System/Subsystem/Equip System	Account	Equip Description	Quantit	Units	Equip ($)	Material	Material ($)	Labor (hrs)	Labor Code	Labor ($)
Heat Recovery Steam Generators										
HRSG System										
Heat Recovery Steam Generators										
	111.1.1.00	HRSG incl surfaces, galleries, steel	1	each	2,385,500	na	0	6,184	SGEN	417,173
	111.1.1.01	Duct Burner System	1	each	78,000	na	0	290	SGEN	19,563
Ductwork										
	111.1.2.01	Bypass Stack	1	each	451,100	na	0	711	SGEN	47,964
Feedwater and Water Supply System										
	111.1.3.01.1	HP Feedwater Pumps and Motors	1	each	25,300	na	0	19	PUMP	998
	111.1.3.01.3	LP Feedwater Pumps and Motors	1	each	800	na	0	2	PUMP	105
	111.1.3.02.1	Condensate Heater	1	each	0	na	0	na	na	0
	111.1.3.02.2	Deaerator	1	each	41,900	na	0	359	SGEN	24,218
Misc Equipment and Systems										
	111.1.6.00	Cycle Water Make-up Pumps and Motors	2	each	251,800	na	0	240	PUMP	12,605
	111.1.6.01	Chemical Feed System (incl pumps and tanks)	1	each	169,500	na	0	775	WTRT	40,362
	111.1.6.03	HRSG Blowdown Tank(s)	1	lot	0	na	45,000	186	TANK	10,396
	111.1.6.04	HRSG Area Duplex Sump Pump Units	2	each	22,000	na	0	72	PUMP	3,781
Water Sampling System										
	111.1.7.00	Water Sampling System	1	each	69,600	na	0	325	WTRT	16,926
Piping Systems (inc hangers and fittings)										
	111.1.8.01.11	High Pressure HRSG Steam Header Piping	56	LF	0	Pipe8A106B	2,400	86	SPNG	5,252
	111.1.8.01.12	High Pressure HRSG Steam Leads Piping	167	LF	0	Pipe8A106B	7,100	256	SPNG	15,634
	111.1.8.01.41	Condensate Header Piping	214	LF	0	Pipe4A106B	4,900	363	SPNG	22,168
	111.1.8.01.51	High Pressure Feedwater Header Piping	241	LF	0	Pipe4A106B	5,600	409	SPNG	24,978
	111.1.8.01.52	High Pressure Feedwater Leads Piping	256	LF	0	Pipe4A106B	5,900	435	SPNG	26,565
	111.1.8.01.71	Low Pressure Feedwater Header Piping	241	LF	0	Pipe4A106B	5,600	356	SPNG	21,741
	111.1.8.01.72	Low Pressure Feedwater Leads Piping	256	LF	0	Pipe4A106B	5,900	378	SPNG	23,084
	111.1.8.02	Valves	1	lot	0	na	52,300	305	SPNG	18,626
	111.1.8.03	Piping Thermal Insulation	1	lot	0	na	6,300	545	PINS	26,302
Condensing System										
Condensate Pumps and Motors										
	111.3.2.00	Condensate Pumps and Motors	1	each	7,500	na	0	18	PUMP	945
Structures for Combustion Turbine Area										
On-site Improvements										
Earthwork										
	210.2.1.01	Clear and Grub	2	acres	0	na	0	36	ETWK	5,229
	210.2.1.02	Site Drainage incl Storm Sewer System	1	lot	0	na	1,200	28	YDRN	1,705
	210.2.1.03	Grading incl Cut and Fill	2	acres	0	na	0	10	ETWK	1,453
	210.2.1.04	Site Fencing	1,246	LF	0	Fence	0	262	LAND	11,195
	210.2.1.06	Landscaping	1	lot	0	na	200	27	LAND	1,154
On-site Roads and Parking Areas										
	210.2.2.01	Permanent Roadways	160	LF	0	Road	0	368	PBIT	24,958
	210.2.2.02	Permanent Parking Areas	1,478	SY	0	Parking	0	739	PBIT	50,119
Outdoor Tanks and Foundations										
	210.2.3.01.1	Fuel Oil Storage Tank - Earthwork	1	lot	0	na	0	0	EXFD	0
	210.2.3.01.2	Fuel Oil Storage Tank - Concrete Ring Foundation	1	lot	0	na	0	0	FORM	0
	210.2.3.01.3	Fuel Oil Storage Tank - Erosion Control on Dike	1	lot	0	na	0	0	MSTR	0
	210.2.3.02.1	Treated Water Tank - Earthwork	2,416	SF	0	na	0	97	EXFD	7,179
	210.2.3.02.2	Treated Water Tank - Concrete Ring Foundation	1	lot	0	na	13,400	943	FORM	42,944
	210.2.3.03.1	Waste Neutralization Tank - Earthwork	324	SF	0	na	0	15	EXFD	1,110
	210.2.3.03.2	Waste Neutralization Tank - Concrete Ring Fnd	1	lot	0	na	800	82	FORM	3,734

SOAPP-CT.25 Output

- Text output to screen or printer
- 33 individual reports in the seven categories:
  - Design Inputs
  - Heat Balance Results
  - Equipment Design Information
  - Project Schedule
  - Capital Cost Estimate
  - O&M Cost Estimate
  - Financial Analysis and Cash Flow

Other software on the horizon

- **Process Heating Screening Tool** – being developed by E3M, Inc. for ORNL, the windows-based tool will evaluate the potential of using waste heat from combustion turbines for direct process heating applications. Three process heating applications typically found in process industries will be modeled for use with a library of typical combustion turbines. Expected release in 2003.

Software Summary

Screening Tools

Software Name	Primary Application	Cost	Reference
Cogeneration Ready Reckoner	Industrial CHP	Free	http://www.eere.energy.gov/der/chp/chp-eval2.html
RECIPRO	CHP using recip engines	$1,500.	http://www.thermoflow.com/
PDE	Industrial CHP using gas turbines	$3,000.	http://www.thermoflow.com/
BCHP Screening Tool *	Building CHP	TBD	http://www.bchp.org/finance-economic.html#screen
Building Energy Analyzer	Building CHP	$800.	http://www.interenergysoftware.com/
D-Gen Pro	Building CHP	$695.	http://www.interenergysoftware.com/

* Under development

Software Summary (cont'd.)

Design Tools

Software Name	Primary Application	Cost	Reference
HeatMap CHP	Industrial CHP/ District Energy	$4,000	http://www.energy.wsu.edu/software/HEATMAP/
GT Pro	Industrial CHP using gas turbines	$7,000	http://www.thermoflow.com/
SOAPP-CT.25	Industrial CHP using gas turbines	$7,500	http://www.soapp.com/soapp/dg/