



The Solutions Network

Rochester, New York

FEMP CHP Core Team Technical Assistance

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Oak Ridge National Lab (ORNL) is DOE's lead lab for CHP R&D and tech transfer/deployment



Integrating Technologies Into Packages



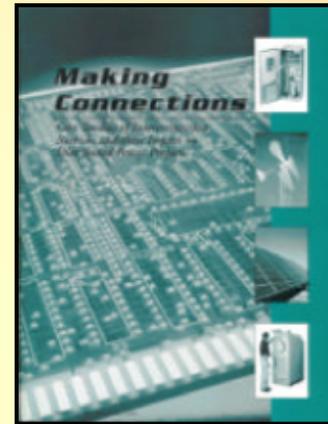
- Packaged CHP Systems
- Thermally Activated Technologies

www.energy2004.ee.doe.gov



End-Use Integration

- Industrial DG and CHP Applications
- District Energy
- Buildings

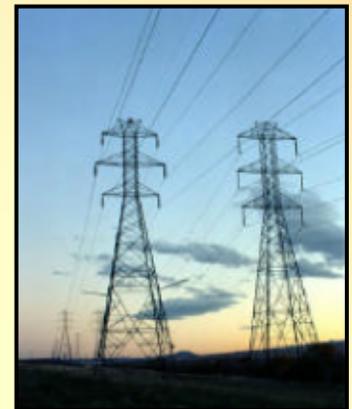


Integrating Distributed Resources with Grid

- Transmission and Distribution (T&D) Technologies



- Electric Industry Restructuring and Grid Reliability



Advanced Reliable Electric Power

Technical Assistance



- CHP screenings (free to federal agencies)
- CHP “headwind” evaluation (ad hoc or agency funded)
- CHP TA (customized to need, ad hoc or agency funded)
- CHP light touches once ESPC ESCO is engaged
- Energy security

ORNL First-Order CHP Screening Spreadsheet



- Microsoft Excel
 - Data Input Forms
 - Visual Basic procedures and functions
 - Graphical and tabular results

A screenshot of a software application window titled "ORNL CHP First Order CHP Screening Tool". The window has a menu bar with tabs for "1. Energy", "2. System", "3. Indices", "4. Cost & Heat Use", "5. Results", and "6. Graph". The main content area is divided into several sections:

- 1. Site Name:** A text box containing "Chicago Hospital".
- 2. Electricity:** Four input fields: "a. annual cost of electricity" (\$1,560,000), "b. annual electric consumption" (23,507,000 kWh), "c. summer peak demand" (700 kW), and "d. winter peak demand" (1,200 kW).
- 3. Natural Gas:** Two columns: "Annual Cost" and "Consumption". Under "Annual Cost" is a field for "\$608,000". Under "Consumption" is a field for "145,603". Below these are three radio buttons: "MMBtu (dekatherms)" (selected), "therms", and "thousand cubic feet".
- 4. Other Fuels:** Two columns: "Annual Cost" and "Consumption". Under "Annual Cost" is a field for "a. fuel oil". Under "Consumption" is a field for "a. fuel oil" with the unit "gallons / year". Below these are two more rows: "b. coal or other fuels" with "Annual Cost" and "Consumption" fields, and the unit "tons / year".
- 5. Average Energy Costs:** Two rows: "a. average cost of" with the value "\$0.066 / kWh" and "b. average cost of fuel" with the value "\$4.18 / MMBtu".

At the bottom right of the window are two buttons: "Reset" and "Exit".

ORNL First-Order CHP Screening Spreadsheet



Microsoft Excel - Dev Ver First Order CHP Analysis

File Edit View Insert Format Tools Data Window Help

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Sample Data

LEGEND

- Constant Cost
- Current Cost Fuel
- Current Cost Power

Simple payback at current energy rates is 5.8 years. Payback at \$0.089 / kWh and \$5.30 / MMBtu is 5.8 years.

Synopsis

- Current energy costs are \$0.089 / kWh for electricity and \$5.30 / MMBtu for fossil fuel.
- Results are for 250 kW of microturbine generator(s) at a net installed cost of \$1,870 / kW.
- 100% of the power generated is used on site.
- Generator O&M costs are \$0.0113 / kWh and utility standby charges are \$24.00 / kW / y.
- Generator heat rate is 12,049 Btu / kWh; heat recovery rate is 1.12 MMBtu / h; 100% of recovered heat can be used; generator operates 8,572 h / y.
- Recovered heat is used in lieu of fossil-fired heat (100%, 0.72), electric heat (0%, 0.99), chilled water (0%, 0.00, 0.65), and desiccant regeneration (0%).
- Simple payback is 5.8 years with a financed payback at 7.4 years.

ORNL CHP First Order CHP Screening Tool

1. Energy | 2. System | 3. Indices | 4. Cost & Heat Use | 5. Results | 6. Graph

1. Site Name: Sample Data

2. Electricity

a. annual cost of electricity: \$312,795

b. annual electric consumption: 3,520,000 kWh

c. summer peak demand: 462 kW

d. winter peak demand: 495 kW

3. Natural Gas

a. natural gas data Annual Cost: \$147,351 Consumption: 278,021

MMBtu (dekatherms) therms thousand cubic feet

4. Other Fuels

a. fuel oil Annual Cost: Consumption: gallons / year

b. coal or other fuels Annual Cost: Consumption: tons / year

5. Average Energy Costs

a. average cost of: \$0.089 / kWh

b. average cost of fuel: \$5.30 / MMBtu

Reset Exit

User Interface | Data | Plot Data | Input Report | Output Report | Dehumidifiers | Default Values

Screening Input Data



- Input form will be provided to agency upon request
- Energy
 - Electricity
 - Annual cost
 - Annual consumption
 - Summer peak demand
 - Winter peak demand
 - Fuel (natural gas, fuel oil, coal, other)
 - Annual cost
 - Annual consumption

Screening Input Data (Continued)



- Existing heating system description
 - Equipment
 - Distribution system
 - Heating capacity
- Existing cooling system description
 - Equipment
 - Distribution system
 - Cooling capacity
- Operating hours

CHP Parameters that can be Evaluated



- Prime mover/generator technologies
 - Number
 - Type
 - Combustion gas turbine
 - Natural gas IC-Engine
 - Microturbine
 - Fuel Cell
 - Capacity
 - Hours of operation

CHP Parameters that can be Evaluated (continued)



- Waste heat utilization
 - Fraction of recoverable that is useful
 - Allocation of recoverable waste heat
 - Space heating and hot water (fossil fired)
 - Space heating and hot water (electric)
 - Chilled water production (absorption chiller)
 - Desiccant regeneration
 - Costs
 - Equipment
 - Operation and maintenance (O&M) (\$/kWh generated)
 - Standby fees (\$/kWh generated)

ORNL First-Order CHP Screening Output

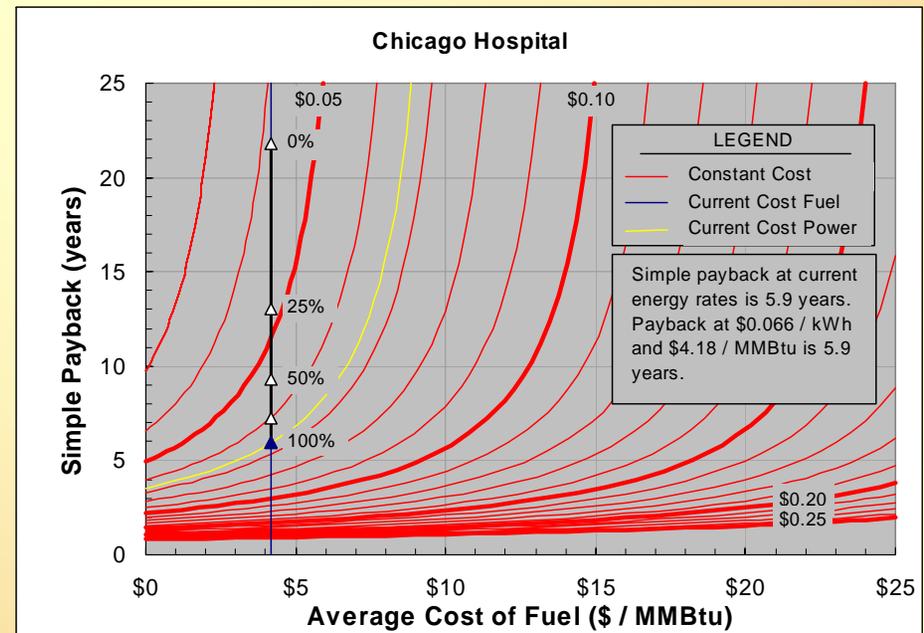


- Net project cost
- Recoverable waste heat
- Increased costs
 - Fuel and O&M cost (\$/kWh generated)
 - Standby charges
 - Total increased cost
- Avoided costs
 - Purchased electricity
 - Boiler fuel
 - Electricity for chiller operation and/or dehumidification
 - Total avoided cost
- Net savings / losses from operation
- Simple payback

ORNL First-Order CHP Screening Output



- Graph of simple payback vs. fuel cost for fixed cost of electricity (assuming 100% use of recovered heat)
- Parametric results for 0% to 100% recovered heat use



CHP “Headwind” Evaluation



- Available incentives
- Requirements for permitting and inter-connection
- Standby/backup charges
- Exit fees
- Ad hoc or agency funded

CHP Customized Technical Assistance



- Site surveys
- Data collection
- Level II energy analysis
- Performance/cost estimation for various configurations of prime movers and components
- Ad hoc or agency funded

Level II Energy Analysis



- Performed using the TRaNsient System Simulator (TRNSYS)
- Algebraic and differential equation solver
- Library of common “energy system” and “CHP” components
 - Utility Components
 - Equipment Components
 - Physical Phenomena Components

Level II Energy Analysis (continued)



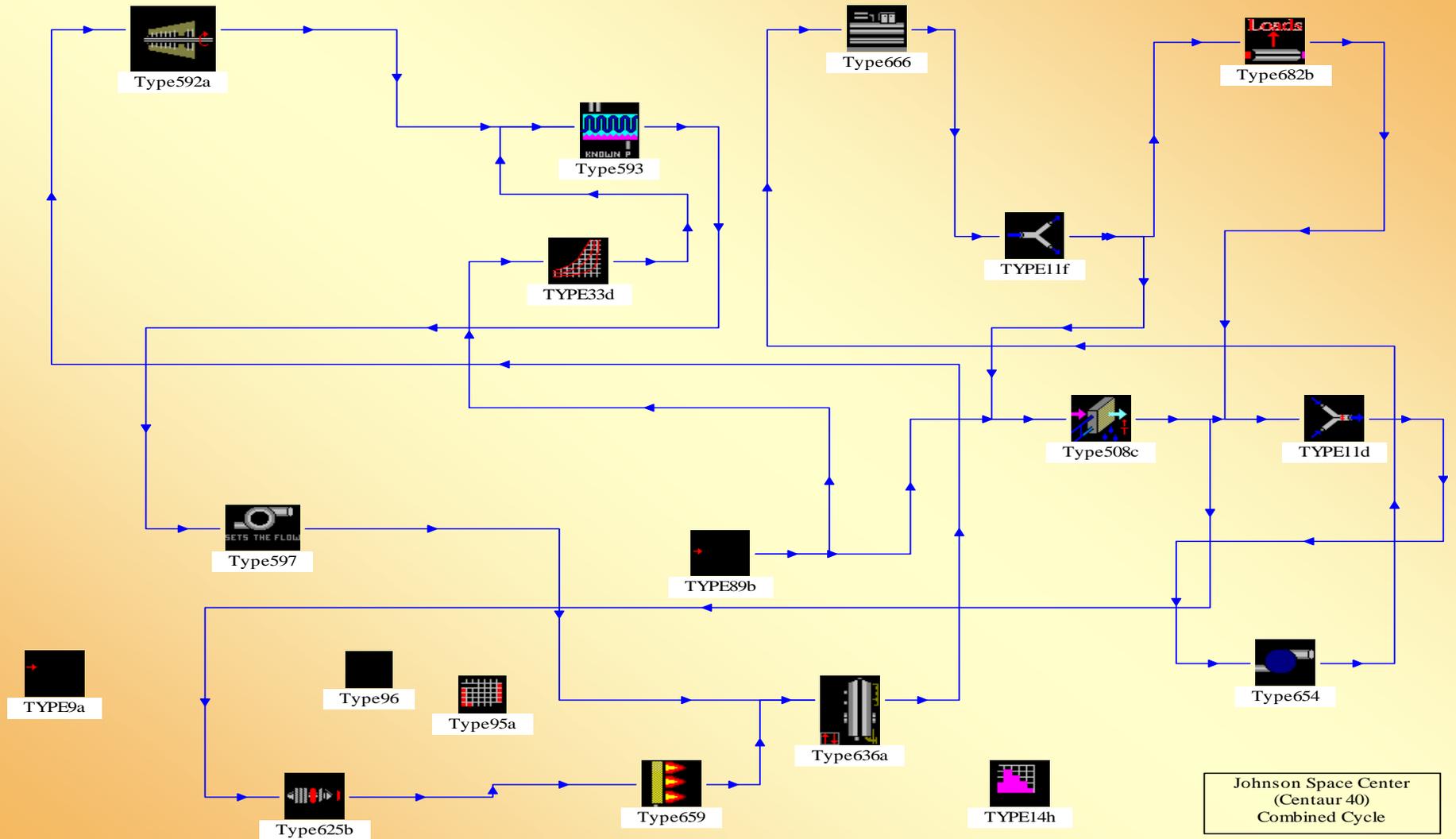
- Components require two types of information
 - Parameters: time-independent quantities
 - Inputs: time dependent quantities
- Components provide desired variables as output

Level II Energy Analysis (continued)

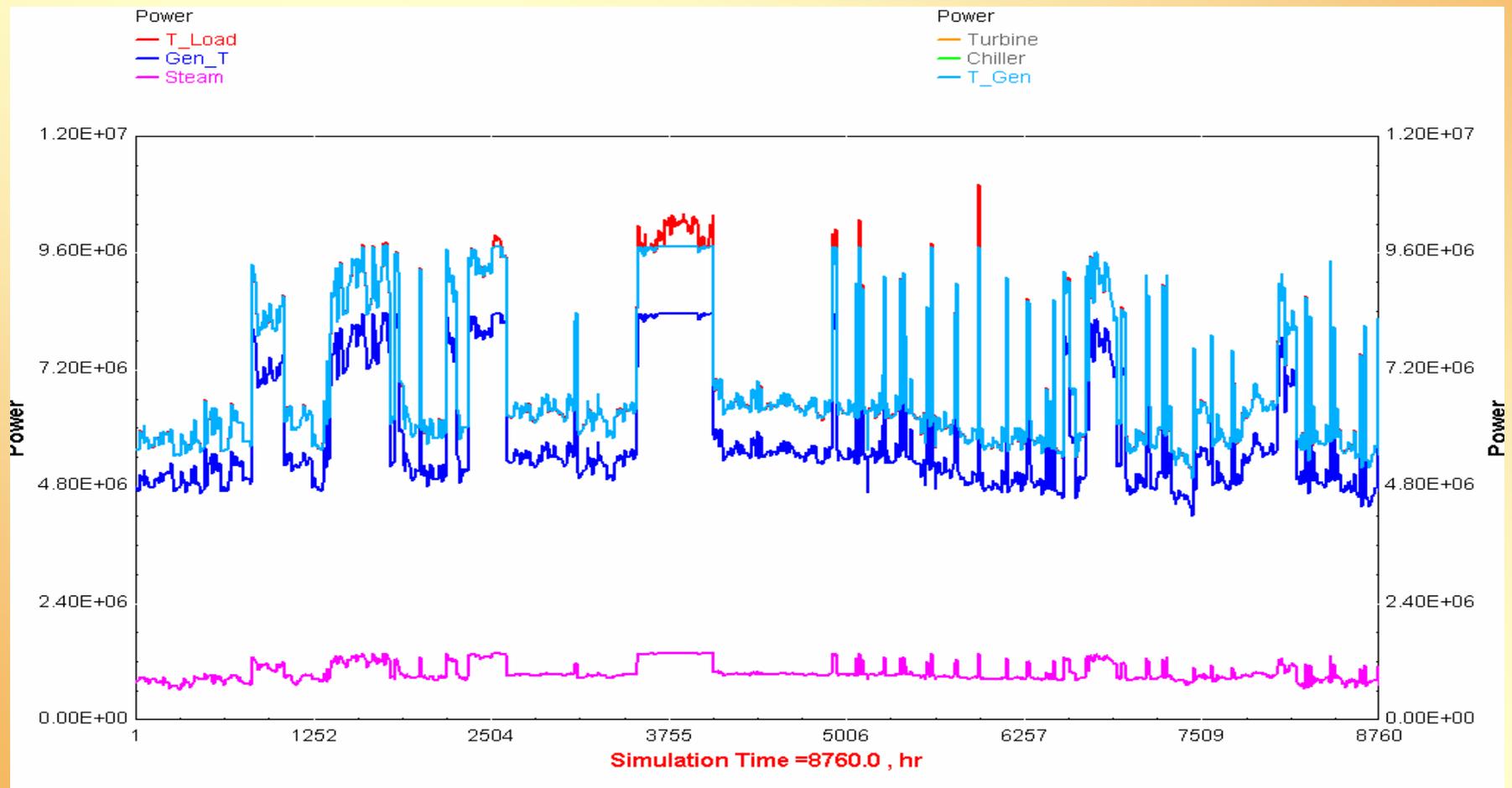


- System simulation uses modular approach
 - Each equipment component represents a process
 - Components are connected in logical order
 - Performance of the system is simulated by simulating performance of individual components
- Simulation time step is user defined — hourly simulation

Example TRNSYS Model



Example TRNSYS Results



Information Required for Level II Analysis



- Description/drawings of existing systems
 - Flow rates (steam and/or hot water, and chilled water)
 - Boiler capacity and efficiency
 - Chiller capacity and efficiency
 - System schematics
- Electrical load profile (hourly)
- Fuel usage or thermal load profile (monthly total)
- Electrical rate schedule
- Fuel cost

FEMP Ad Hoc Funding



- CHP Core Team technical review and analysis
 - Sites with strong CHP potential based on initial screening
 - Site champions
- Each project will be approved in advance by HQ via ad hoc request process
 - Must be supported by the DOE Regional Office
 - Scope of work
 - Estimated cost

FEMP Ad Hoc Funding (continued)



- Support will be strategically targeted to facilitate next steps toward project completion.
- Services include technical/ economic/ configuration analyses, modeling, site visits, reviews of proposals, etc.

CHP Light Touches



- Review services provided in support of ESPC project facilitators
 - Preliminary surveys
 - Initial proposals
 - Detailed energy surveys
 - Final proposals
 - Savings calculations
 - Design submittals
 - Energy use baselines
 - M&V plans

EDUCATION AND OUTREACH



- TRAINING/WORKSHOPS
- DER “HOW TO” GUIDE
- CASE STUDIES
- OUTREACH MATERIALS

<http://www.eere.energy.gov/femp/>

Energy Security



- Various policies, guidelines, mandates for feds:
 - GSA Federal Guidelines for emergency plans and procedures for utility services (2003)
 - Homeland Security Presidential Directives 7 & 8: preparedness performance measures and asset inventories (Dec/03)
 - FEMA Preparedness Circular and prior Executive Orders—
COOP: Assure continuity of essential operations in event of emergency (2001)
 - Executive Orders on Critical Infrastructure Protection and Emergency Preparedness Responsibilities (# 12656)
- Bottom line:
 - Installations must ensure that energy is available for all critical mission operations

FEMP Energy Security Goals



- New action plan is under development to:
 - Assist agencies to develop plans for assuring reliable power
 - Encourage agencies to use DER/CHP and renewable energy technologies as means to address reliability and other energy concerns.

ADD CHP (Accelerated Development and Deployment of CHP for Federal Facilities)



- Goal is to make proven and advanced technology more easily accessible to federal agency sites who want to lead by example with DG/CHP
 - Access private industry project development expertise, financing, etc
 - Enhance energy security and reliability
 - Replace old equipment
 - Reduce costs

Alternative Financing

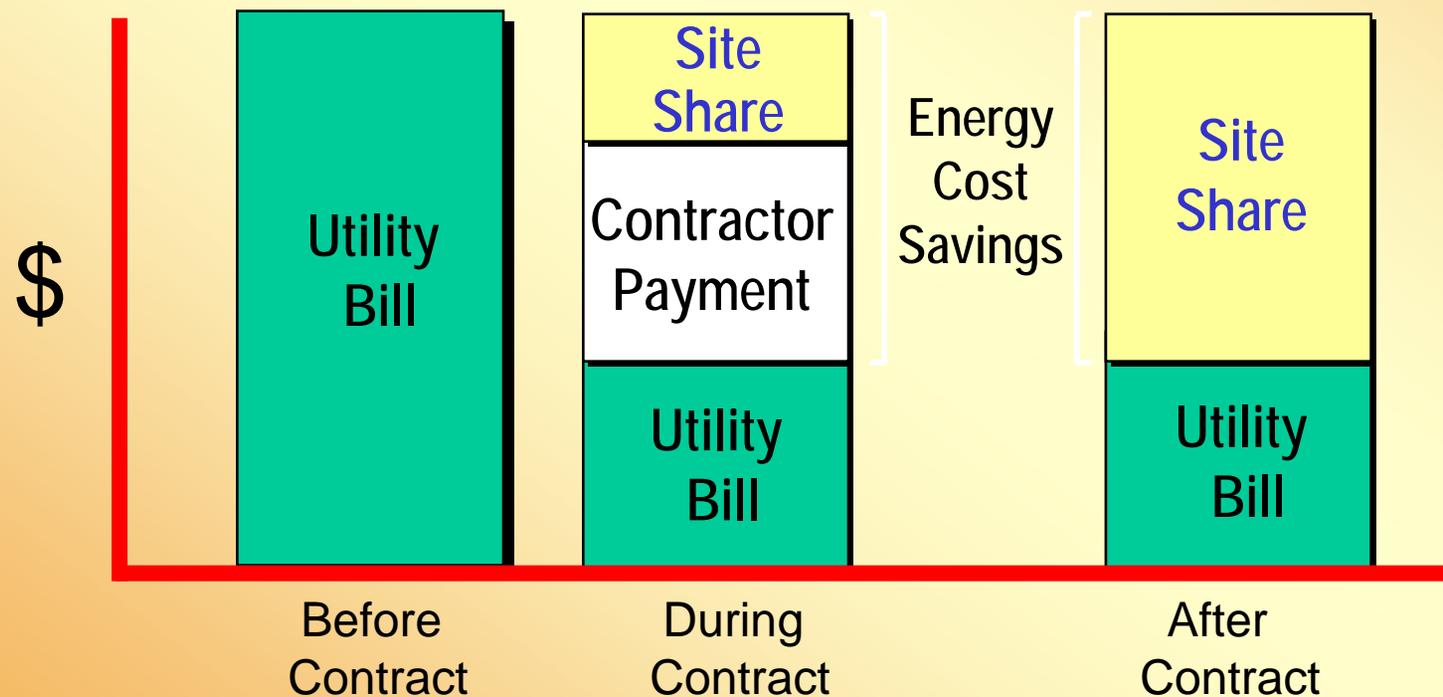


- A contracting method whereby the contractor incurs the cost of implementing energy-conservation measures and is paid from a share of the energy and energy-related savings directly resulting from implementation of such measures during the term of the contract.

Performance Contracting — Reallocating the Site's Utility Budget



- ✓ Pay a lower utility bill
- ✓ Pay the contractor
- ✓ Achieve cost savings for the site



Alternative Financing Programs



ESPC

- Site-Specific ESPCs
- Regional Super ESPCs
- Technology-Specific Super ESPCs
- Army IDIQ ESPCs
- Air Force IDIQ ESPCs
- Navy Use of ESPCs
- DESC Use of ESPCs
- Other

UESC

- GSA Areawide Contracts
- Basic Ordering Agreements
- Site-Specific Agreements
- Agency-Specific Agreement

Contacts



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