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Phoenix, AZ

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A Case Study in Fuel Cell Market Transformation

Potential Opportunities for Fuel Cell Power at DOE Germantown Data Center * : The Pros and Cons of Energy Savings and Service Agreements

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**** A Joint Project with Energy Information Technology Service, Office of the Chief Information Officer (OCIO)***

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Leading the Way to Energy Security

- Examples of Congressional and Administration Direction
  - EPACT 1992, 2005 & EISA 2007
  - Executive Order 13123 and 13423
  - National Energy Conservation Policy Act –NECPA- (P.L. 99-272)
  - The Information Technology Management Reform Act of 1996 (Clinger-Cohen)
  - Federal Property and Administrative Services Act of 1949
  - …and more
- GAO
  - B-287488 General Counsel Letter, Senator Joseph I. Lieberman, Chairman, Committee on Governmental Affairs, "Issues related to share-in-savings contract authorities of the National Energy Conservation Policy Act and the Clinger-Cohen Act," June 19, 2001
  - GAO-05-55 Report – "Partnerships and Energy Savings Performance Contracts Raise Budgeting and Monitoring Concerns"
- EERE Transformational Energy Action Management (TEAM) Initiative

"Service" vs "Savings"

- Both Energy ***Savings*** Performance Contracts (ESPC) and Utility Energy ***Service*** Contracts (UESC) are debt-based financing mechanisms.

- Both ESPC and UESC loan amounts include engineering assessment, project management, and overhead costs, as well as a separate charge for private company profits or utility operating margins.

- ESPC loan repayment comes from the energy cost savings generated by undertaking the project and the cost savings must be guaranteed (mandated by law) before the government will approve implementation of the ESPC project.

- UESC loan repayment can come from the project's corresponding cost savings or other federal or private sources and project suitability is evaluated by an analysis of the technology's life cycle cost (LCC).

Fuel Cell Powered Data Center Case Study
IT Operations

Energy Saving (estimates*)	*Upgrade the energy efficiency of IT equipment & implement "best practices" computing operations*
20%	Relocation - reduction of redundant cooling and power conditioning systems
15-20%	Consolidation - new "blade" server platforms
60-80%	Virtualization - IT applications move from single-use to virtual server environments
20-50%	Upgrades of Legacy IT Equipment - tier disk storage equipment, integrate power management of old racks, localize equipment cooling
10-30%	"Best Practice" Operations - upgrade facility infrastructure equipment/systems

* Based on OCIO preliminary assessment of Germantown data center opportunities

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Fuel Cell Powered Data Center Case Study

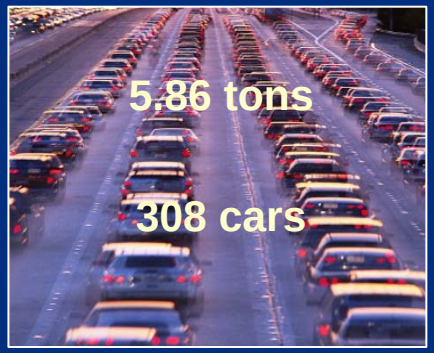
Showcasing Fuel Cells' On-site Power Generation capabilities will demonstrate market readiness, commercial viability, as well as:

- environmental benefits
- energy efficiency
- improved reliability
- ability to support the grid's reliability margin

Estimates of annual air emission reductions benefits,

Comparison of the grid to the Germantown fuel cell

CO_2



NO_x

based on the national grid average - regional reductions will vary

(UTC PureCell® 400kW)

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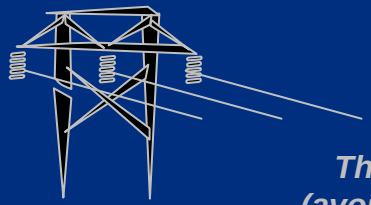
Fuel Cell Powered Data Center Case Study
Energy Efficiency Benefits

On-site power generation with a critical load CHP fuel cell system* at the Germantown data center can provide a:

- 32% improvement (345 kW net energy avoided) in energy efficiency, and
- 1068 kW improvement (reduction in electricity demand**) in grid reliability margin for the state of Maryland.



The Grid
(avoided kW)

825 (275 x 3)[1]	data center IT load (275kW)
60 (20 x 3)	chilling contribution to data center
181	space and hot water domestic heating
1068	**Total**

kW avoided

1068 - 723
= 345 kW

The Fuel Cell
(kW equivalents of natural gas)

723	grid independent data center IT load & CHP chilling[2] and heating[3]
723	**Total**

UTC PureCell® 400*

*[1] current IT load** is estimated to be 275 kW. Onsite generation is 3 times more efficient than electricity delivered from the central power plant thru grid*
[2] 34 tons of waste heat running an absorption chiller
[3] heat exchanger provides 181 kW of heating

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Commercial Fuel Cells

Examples Show Full Reliability

First National Bank of Omaha Omaha, Nebraska

Since 1999 fuel cells have powered the data center for the in-house merchant credit card processing of the largest U.S. private banking company with assets nearing $20 billion. Fuel cells were chosen for reliability and their ability to protect loss of critical core business processes calculated to be $7 million/hour. **7.5 "nines" of availability validated by independent MIT report.**

Juvenile Training Center, Middletown, Connecticut

Six fuel cells create a 1.2 MW microgrid (equivalent to the energy supply for 1000 homes) that provides electricity and 24/7 heating and cooling demands for a self contained, independent and secure environment. (commissioned 2001)

Verizon Garden City, New York

Seven units totaling 1.4 MW for a 332,000 sq. ft. facility critical call routing center that is responsible for air traffic control in the northeast corridor.

Central Park Police Station New York, New York

Between commissioning in 1999 and May 2006, fuel cells provided over 61,000 hours of uninterrupted power. During the Northeast Blackout in 2003 this facility didn't even know the rest of NYC had gone dark.

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Case Study Contracting Options

	ESPC	UESC	PPA/ESA
Intent of purchase			
a) Goods – new EERE technology	Yes	Yes	No
b) Comprehensive Service – dedicated power for a specific facility or activity	No	Yes	No
c) Generic power "blocks" - base or peak load	No	Maybe	Yes
Source of "Lending"	Private company	Public ratepayer & private company, or private equity investor	Public ratepayer, or private equity investor
Flexibility of provisions			
a) project eligibility	No, mandated guarantee based on metered energy cost savings	Yes, "life-cycle cost effectiveness analysis	Maybe, depends on state law and utility implementation of RECs
b) (re)payment	No initial engineering analysis No "buy-out"	Yes initial engineering analysis Yes "buy-out"	? initial engineering analysis Yes "buy-out"
Repayment source			
a) assets	Appropriations	Appropriations, or developer (UESC) private equity investor	Utility RECs, developer private equity investor
b) power costs/utility charges	Appropriations	Appropriations	Appropriations
Ownership of Project Assets	Government & private company	Government & private company private equity investor	Government private equity investor
Applicability			
a) government	Yes	Yes	Yes
b) private sector	Yes	Yes	Maybe
c) state regulated utility	No	No	Yes

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Case Study Financing Options
Contract Restructuring

Create government cost saving opportunities by separating the energy service contract into three parts – the engineering assessment, purchase and installation of capital assets, and day-to-day operations and maintenance – and then "bundling" the capital costs of the assets to enable future buy-outs.

Cost Structure of a Typical Energy Savings/Service Project Contract

Germantown Case Study - Identified UESC contract vehicle allows:

1) bundling of project assets, e.g. fuel cell, IT equipment, and facility up-grades
2) independent engineering assessment to be funded separately by the Program
3) buy-out of assets

[1] fuel costs (grid electricity to natural gas,) day to day operations & maintenance currently covered by the Department's working capital fund

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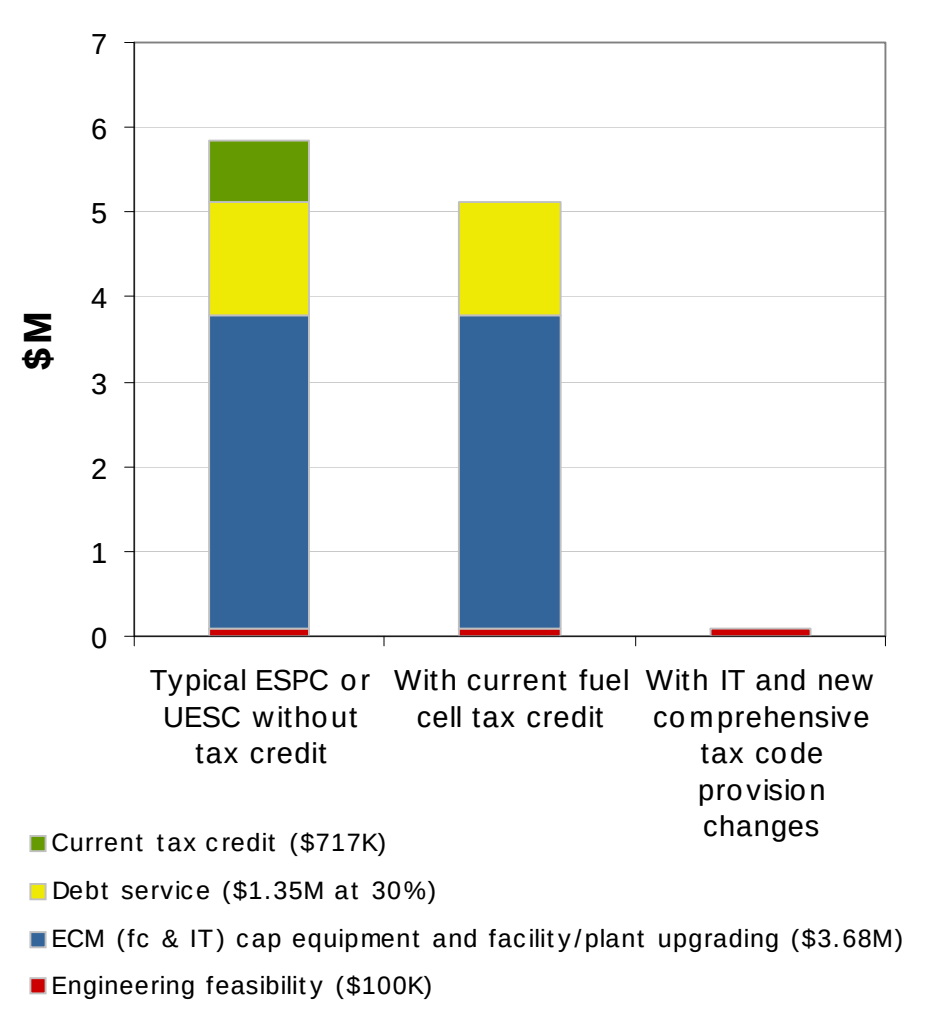
Case Study Financing
Creating Government Cost Savings



- Tax credits, analogous to IRS "economic stimulus" tax code provisions, afford the Government the large cost saving opportunities for market transformation deployments.
- When economic stimulus-based investment tax credits are used in conjunction with UESC "buy-out" or the ESA "buy down" provisions, the government eliminates the obligated asset and debt service cost repayment.
- Current tax credits represent ***only*** a 10% price reduction, specifically for the energy related technology, but economic stimulus-based tax credits that cover the entire projects capital investment could save the government 90% or more of appropriated funds needed to cover deployment costs.

"…use federal tax policy to catalyze and accelerate private infrastructure financing and capital flows…" *Alexander Karsner, before the Committee on Appropriations, Subcommittee on Energy and Water, United States Senate, May 8, 2007*

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Conclusions

- Commercial fuel cells can offer improved reliability, energy efficiency, and environmental benefits when compared to the Grid and other intermittent on-site power generation technologies.
- Government deployment can assist the fuel cell industry in early market expansion.
- There is considerable Congressional, Administration, and Departmental level policy, in addition to the most recent EPACT legislative provisions, to support fuel cell early market activities.
- Government energy service, rather than energy savings contracts, can be better suited when mixing new market entrant technologies and improvements in energy-related operations and best practices.
- Energy service contracts or agreements based on equity ownership and tax-based incentives may offer the best value for Government funding.

Back-up

IRS Tax Code Sections*

- Low Income Housing – IRC § 42
- Historic/Rehabilitation – IRC § 47
- New Markets Tax Credit – IRC § 45D

} "economic stimulus" sections that provide the basis for private equity LLC buy-out

- Production Tax Credit – IRC § 45
- Energy Tax Credit – IRC § 48
- Ethanol Tax Credit – IRC § 40
- Biodiesel Fuel Credit – IRC § 40A
- Energy Efficiency – IRC § 179D
- Energy Efficiency Rebates – § 136

  - § 42, 47, & 45D use investment tax credit (forgiveness) to "tax hungry" corporate entities to induce ownership (equity investments) in affordable housing, historic rehabilitation, and new markets for community redevelopment

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* Source - Reznick Group

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