

New York State Energy Highway Task Force
Request for Information – May 2012

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UTC Power Brief

United Technologies Corporation (UTC) is a Fortune 50 corporation with more than 3200 employees and 43 facilities in the State of New York. UTC Power, a United Technologies company, has led in the development, design, production and service of fuel cells for use in stationary, transportation, space and defense applications for over 50 years. Today UTC Power is providing a fuel cell solution for stationary applications. UTC Power's solution, the PureCell® Model 400 is a sustainable energy generation system, with a combined heat and power efficiency approaching 90%. This high system efficiency can be compared to a central powerplant efficiency of ~35%. Our stationary fuel cells operate without combustion, make minimal noise and meet the most strict air standards in the United States.

Fuel cell technology solutions benefit customers by providing higher system efficiencies within a broad range of applications. A fuel cell converts its input fuel directly into electricity, allowing the fuel cell to operate at much higher electrical efficiencies than other traditional power generation technologies. More simply, a fuel cell produces a larger amount of electricity for the same fuel input.

The environmentally friendly features of the PureCell® Model 400 help states, utilities and other customers reduce their overall carbon footprint, reduce water usage and contribute to eliminating additional emissions, such as nitrogen oxide.

Potential Economic Benefit of Fuel Cells in New York State

UTC Power expects incremental sales volume increases to boost the current direct and indirect fuel cell employee base within New York and reduce the overall cost of the fuel cell powerplants.

Deployment of large fuel cell projects in support of the Energy Highway would lead to the cultivation of in-state job creation. Fuel cell projects require several job functions throughout the design, installation and service phases. When a customer or end user begins a fuel cell project, much like any other equipment installation for long term operation, site design work is required. For New York State projects, in-state site design and engineering firms would typically be hired and utilized. In state firms possess a greater understanding of the permitting and siting processes at the municipal level which can help to decrease the project development timing. The type of work

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completed by the design firm is carried into the installation portion of the project, which also benefits from hiring in-state personnel.

Once a fuel cell system has been designed and installed, the service portion of the operation commences. UTC Power hires local service technicians to maintain our fuel cell products throughout their lifetime, which is a minimum of 20 years. In addition to hiring local support for fuel cell projects, these projects also promote the establishment of in-state maintenance facilities and warehouses. The establishment of full time local support is the creation of green jobs. A current estimation of the number of green jobs created in-state is 1 job for every 3 fuel cell installations.

Support infrastructure is not limited to the service portion of the project. Stationary fuel cells operate on natural gas, converting it to electricity without combustion. Due to the use of natural gas to create low emission electricity, an appreciable increase in fuel cell deployment would stimulate an expansion of natural gas infrastructure within the State. The economics of extending the availability of natural gas beyond existing locations work extremely well when operating natural gas fed fuel cells. Fuel cells require a constant level of natural gas that is consistent with typical requirements to develop and/or extend natural gas infrastructure. The volume of natural gas consumed is also consistent due to the base load operation of the fuel cell and not weather dependent.

By installing fuel cells to provide power to utility distribution systems, the State of New York would increase the number of local jobs needed to support fuel cell project design, installation and long term operation. Additionally, natural gas fuel cell projects provide adequate consumption rates to entice natural gas utilities to expand their current infrastructure. Increased natural gas availability aids in the implementation and execution of other State-developed and funded programs for residential energy efficiency, reducing the overall amount of crude oil burned in the State.

Opportunities for Fuel Cells in New York State

A diverse set of market segments currently benefit from fuel cell power generation. New York State fuel cell installations include secondary and university education facilities, bottling facilities, mixed use residential buildings, hotels and supermarkets. Additionally, fuel cells are being utilized by municipalities, hospitals, prisons and utilities.

The capability to capture heat from a fuel cell offers a unique opportunity for deployment within a utility territory, while providing additional benefits to its ratepayers. By locating the fuel cells at end user locations and delivering power to the distribution network, utilities can take advantage of the clean and efficient generation of electricity while providing added benefits to ratepayers in the form of recovered heat

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and/or chilled water for cooling. Total system efficiencies can be optimized and approach 90%.

As part of the Energy Highway initiative, a few examples of where distributed power generated by fuel cells could offer resiliency and increased efficiency include: along the rail lines within New York State, secondary education facilities, SUNY campuses and regions within the State where the power per square foot needs to remain small due to space constraints.

Aside from the environmental benefit of reducing carbon emissions, end users who install and operate fuel cells reduce their electricity and water consumption significantly. When these savings are combined with the carbon footprint reduction, fuel cell installations offer direct environmental and resource demand benefits to the State as well as the end user.

Lastly, stationary fuel cells offer base load power, eliminating the reliability concern associated with intermittent technologies, like wind or photovoltaic power sources. Additionally, some fuel cell systems fulfill the need for grid isolation, as the product can provide electricity and heat with or without grid power present. This feature is beneficial in the event of a grid outage to keep electricity and heat available to schools, emergency shelters and critical facilities in town centers through the use of micro grids.

UTC Power Recommendation to New York State Energy Highway Task Force

The Energy Highway task force should consider including a directed, multi-year deployment plan for fuel cell technologies. Fuel cell projects offer the capability to increase power resiliency, decrease grid power demand, and provide an overall environmental benefit to the State of New York and should be considered as part of the Energy Highway solution. There are successful examples of utility owned fuel cell projects where the equipment is installed on the utility side of the meter. PureCell Model 400 projects under the Energy Highway program can be configured to provide power to the utility distribution system during normal conditions and backup power to host facilities during periods of grid outage. Regardless of the location of the project relative to a potential thermal host, the environmental, cost and job benefits for both the customer and the State can be obtained.

To effectively contribute to the Energy Highway initiatives, a commitment from the State for a multi-year deployment plan consisting of 250MW over the first five years and another 500MW over an additional five years would be appropriate. For reference, recent calculations indicate the following avoided carbon dioxide and nitrogen oxide emissions with the deployment of combined heat and power fuel cells:

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For 250 MW with only 25% waste heat utilization, approximately 270 metric tons of nitrogen oxide and 85,000 metric tons of carbon dioxide would be offset. This number is equivalent to planting 19,600 acres of trees or eliminating 15,600 gasoline vehicles from the road. Additionally the water saved compared to central generation would be 354,000,000 gallons, which is equal to 550 Olympic sized swimming pools.

Similarly, for 500 MW approximately 540 metric tons of nitrogen oxide and ~170,000 metric tons of carbon dioxide would be offset. This number is equivalent to planting 39,200 acres of trees or eliminating 31,200 gasoline vehicles from the road. Additionally the water saved compared to central generation would be 709,000,000 gallons, which is equal to 1,100 Olympic sized swimming pools.

The large volume fuel cell deployment helps bring equipment costs down more quickly and also helps to increase job growth more rapidly. Installation of hundreds of megawatts of fuel cells would drastically decrease the carbon foot print of the State while provide power and heat at a capacity factor over 90%, which is significant when compared to the capacity factor of variable technologies like solar photovoltaic and wind.

Including a clean and efficient distributed generation technology, like fuel cells, in the Energy Highway mix allows the State to create a diverse solution to meet its energy and sustainability goals.