



The Computerworld Honors Program

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Final Copy of Case Study

Year:
2013

Status:
Laureate

Organization Name:
HP

Organization URL:
www.hp.com

Project Name:
HP Net-Zero Energy Data Center

Category
Economic Development

Please provide an overview of the nominated project. Describe the problem it was intended to solve, the technology or approach used, how it was innovative and any technical or other challenges that had to be overcome for successful implementation and adoption. (In 300 words or less.)

With the Net-Zero Energy Data Center research, HP aims to provide businesses and societies around the world the potential to operate data centers using local renewable resources, removing dependencies such as location, energy supply and costs. This opens up the possibility of introducing IT services to organizations of all sizes. Information technology has the power to be an equalizer across societies globally, but the costs of IT services, and by extension the cost of energy, is prohibitive and inhibits widespread adoption. The HP Net-Zero Energy Data Center not only aims to minimize the environmental impact of computing, but also has a goal of reducing energy costs associated with data-center operations to extend the reach of IT accessibility globally. The HP Net-

Zero Energy Data Center integrates energy and cooling supply from local renewable sources with a novel demand-management approach that allows the scheduling of IT workloads based on resource availability and performance requirements. For example, noncritical, delay-tolerant workloads could be scheduled during daylight hours to coincide with solar supply for data centers equipped with photovoltaic energy generation. In this way, demand can be "shaped" according to resource availability to reduce reliance on non-renewable resources. As a result, organizations can lower overall data center costs – from capital investments in upfront infrastructure technology to the operational costs of workload execution – enabling more customers to take advantage of IT services. HP's state-of-the-art research facility located in Fort Collins, Colo., built in collaboration with HP Labs, also provides a production environment to expand the HP Net-Zero Energy Data Center architecture and related research into demand-management technology. This is a key step in bringing cutting-edge sustainability technologies to market.

When was this project implemented or last updated? (Please specify month and year.) Has it incorporated new technologies and/or other innovations since its initial deployment? (In 300 words or less.)

In May 2012, HP revealed research from HP Labs, the company's central research arm, that illustrates the architecture for a data center that requires no net energy from traditional power grids. The research shows how the architecture, combined with holistic energy-management techniques, enables organizations to cut total power usage by 30%, as well as dependence on grid power and costs by more than 80%. With the HP Net-Zero Energy Data Center research, HP aims to provide businesses and societies around the world the potential to operate data centers using local renewable resources, removing dependencies such as location, energy supply and costs. This opens up the possibility of introducing IT services to organizations of all sizes. The HP Enterprise Group plans to further develop the Net-Zero Energy Data Center technology in collaboration with other HP divisions through the Moonshot Discovery Lab initiative and the HP EcoPOD that is part of the Discovery Lab in Houston. HP's state-of-the-art research facility located in Fort Collins, Colo., built in collaboration with HP Labs, also provides a production environment to expand the HP Net-Zero Energy Data Center architecture and related research into demand-management technology. This is a key step in bringing cutting-edge sustainability technologies to market. HP showcased the HP Net-Zero Energy Data Center architecture at HP Discover, the company's premier client event that took place June 4-7, 2012 in Las Vegas.

Is implementation of the project complete? If no, please describe the project's phases and which phase the project is now in. (In 300 words or less.)

The HP Net-Zero Energy Data Center is currently deployed in a production data center located in Palo Alto, Ca. The implementation and phases are further described in Appendix 1. Reduction of resource consumption in data centers is becoming a growing concern for data center designers, operators and users. Accordingly, interest in the use of renewable energy to provide some portion data centers' overall energy usage is also growing. One key concern is that the amount of energy necessary to satisfy a typical data center's power consumption can lead to prohibitively high capital costs for the power generation and delivery infrastructure, particularly if on-site renewables are used. In Appendix 1, HP introduces a method to operate a data center with renewable energy that minimizes dependence on grid power while minimizing capital cost. We achieve this by integrating data center demand with the availability of resource supplies during operation. We discuss results from the deployment of our method in a production data center. A presentation summary of the HP Net-Zero Energy Data Center can also be seen at: www.slideshare.net/hewlettpackard/hp-net-zero-energy-data-center-media-presentation. A graphic is presented in Appendix 2.

Please provide at least one example of how the technology project has benefited a specific individual or organization. Feel free to include personal quotes from individuals who have directly benefited from the work. (In 300 words or less.)

This project is a newly unveiled innovation. By reducing the cost of data center ownership, organizations of all sizes will be able to take advantage of the power of IT, while tailoring the underlying technology they use to meet their specific business needs. Modern data centers are massive consumers of energy. They also remain surprisingly energy-inefficient. But carefully match their energy supply with demand as dictated by their workloads, and you can seriously reduce those inefficiencies. Combine that with holistic energy demand techniques, and you can lower total data center power costs by 30% and dependence on a larger power grid by more than 80% – plus cut your capital and operational costs as well. That's the argument presented by researchers from HP Labs Sustainable Ecosystems Research Group in a paper at the IEEE's 13th annual Intersociety Conference on Thermal and Thermomechanical Phenomena in Electrical Systems. Titled "Towards the Design and Operation of Net-Zero Energy Data Centers," the paper outlines an innovative management architecture that integrates energy and cooling resources with IT workload planning. It saves energy by employing modules that: – Leverage powerful predictive analytics software to forecast the availability and cost of critical resources like renewable energy and IT workload demand. – Employ a novel optimization algorithm to

schedule workloads based on resource availability. – Manage workload and energy consumption in real-time according to performance requirements and data center operational objectives. – Use verification and reporting to ensure plan accuracy. Design data centers in this way and they can be run by stand-alone micro-grids powered by renewable resources such as sunlight, wind or water – resulting in a net-zero drain on the larger power grid and substantial savings in operating costs for data center owners.

Would this project be considered an innovation, a best practice or other notable advancement that could be adopted by or tailored for other organizations and uses? If yes, please describe that here. (In 300 words or less.)

A ground-breaking innovation from HP Labs, the HP Net-Zero Energy Data Center will help businesses operate data centers while using local, renewable resources, reducing the total cost of ownership and making IT services more affordable. This helps introduce IT services to the masses, enabling small businesses to benefit from the same access to IT as Fortune 500 companies. Typical data centers consume significant amounts of energy. A 2011 study reported that data center power consumption in 2010 accounted for between 1.7% and 2.2% of total electricity use in the United States. The sustainable data center project is a large-scale rethinking of how data centers are designed, built and operated. Managed by HP Labs, the aim is to develop a facility that consumes net zero energy from non-renewable sources over its entire life cycle, from resource extraction and manufacturing to operation and end of life. This means moving away from sources like the public power grid and relying on local micro-grids of renewable energy to offset all or most of a data center's energy needs. HP Labs has also created an IT infrastructure that dynamically allocates resources to shape demand, so that the data center receives the resources it needs when it needs them – and no more. In pilot tests HP Labs is using local micro-grids of renewable energy to reduce a data center's reliance on grid power. HP expects to reduce reliance on the grid by more than 75% while significantly reducing operational costs. This shift to renewable micro-grids can reduce a data center's carbon footprint by an equivalent of 75%.



If there are any other details that the judges should know about this project, please note them here. (In 300 words or less.)

HP Labs is currently deploying many of its sustainable data center technologies in test labs, including advanced cooling technologies at HP Labs Fort Collins, Colorado, data center and renewable power technologies at HP Labs worldwide headquarters in Palo Alto, California. Please see the video on the HP Net-Zero Energy Data Center on YouTube:

<http://www.youtube.com/watch?v=KmHcEbqr2XM&list=PLB66B1E8C9F036D08&index=6>