

# **DOE's Public Database for Green Building Case Studies**

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# DOE's Public Database for Green Building Case Studies

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## SUMMARY

As the number of state-of-the-art green buildings throughout North America grows, the value of these buildings has become abundantly clear to architects, engineers, and other members of building design teams. These “green building” case studies are providing design teams with valuable input related to green features, design processes, energy performance, and comparison to other high-performance, green buildings. This input is helping to improve future design processes and creating more efficient commercial buildings. To help capture this valuable information, the U.S. Department of Energy (DOE) has created an online database for collecting, standardizing, and disseminating information about high-performance, green projects.

Using state-of-the-art Web database technology, the High-Performance Buildings (HPB) Database is designed to contain project information about green buildings at various levels of detail. An “Overview” level describes key project information, including its function and most significant green features. More detailed information about the project is separated into a series of modules on process, performance, and results; this organization allows designers to provide details on all aspects of the project or only on selected topics. In addition to many other search options, HPB Database users are able to select projects that contain details in a particular area of interest.

Available since May 2002, the HPB Database contains information on more than 52 completed green building case studies with another 50 case studies nearing completion. The information collected includes a building's physical attributes, design process, finance and cost, site, water use, landscaping, materials, indoor air quality, and energy use. It uses submitted information to produce case studies of building projects, which include photo galleries as well as bibliographies of any additional information published about the buildings. Anyone can submit a building project to the database for review and eventual publication at [www.highperformancebuildings.gov](http://www.highperformancebuildings.gov).

## 1. INTRODUCTION

Many sustainable buildings have been completed or are currently under construction worldwide. Such buildings are considered leading edge because they address a building's energy efficiency, its environmental impact as well as how it affects its occupants. Considerable information about these buildings exists and making this information available on the World Wide Web offers tremendous potential to help improve future generations of buildings worldwide. In the past, performance information about buildings was limited to aggregate totals of the building stock

(Energy Information Administration 2002), and case studies in books or on CD-ROM. Examples of these case studies include the Green Building Advisor (Building Green 2002) and Green Developments (Rocky Mountain Institute 2002). The work required to create case studies such as the above is often repeated unnecessarily and project teams are inundated with repetitive requests for information.

By collecting and storing building case study information in a Web-based database, the information can be quickly updated and widely accessed. The Database captures the multifaceted nature of sustainable building concepts and provides a mechanism for disseminating information to advance the building industry. The Database features projects with innovations in fields such as energy efficiency, materials use, and water conservation. It can store and display information on projects of all sizes, ranging from campuses and neighborhoods to homes and commercial interiors. Although it is intended to describe projects in great detail, most data fields are optional, so less detailed entries are also possible. Obviously, the more information the HPB Database contains, the more useful the case studies. A wide range of search options is available, allowing users to locate projects of interest by location, building type, size, keyword, and many other parameters.

## **2. DEVELOPMENT AND FORMAT OF THE DATABASE**

A team of building professionals worked with Web developers to create the database. The team included engineers, architects, green building consultants, and publishers of sustainable design information. This team studied existing databases for content, structure, and functionality, and reviewed the ways in which case studies are displayed in print, online, and in public presentations. Based on this review, a generic “case study template” was developed to describe the overall structure and specific fields of a database entry.

Table 1 summarizes the twelve case study topical areas. Most of the areas have a set of high-level metrics. In addition, extensive text fields are available in which users can explain information contained in the section. The “Overview” section contains general information about the project, including location, building use, area, and completion date. Check boxes serve to standardize the type of information collected; however, text fields can be used to elaborate on specific techniques and methods that make the project unique.

## **3. USE OF THE DATABASE**

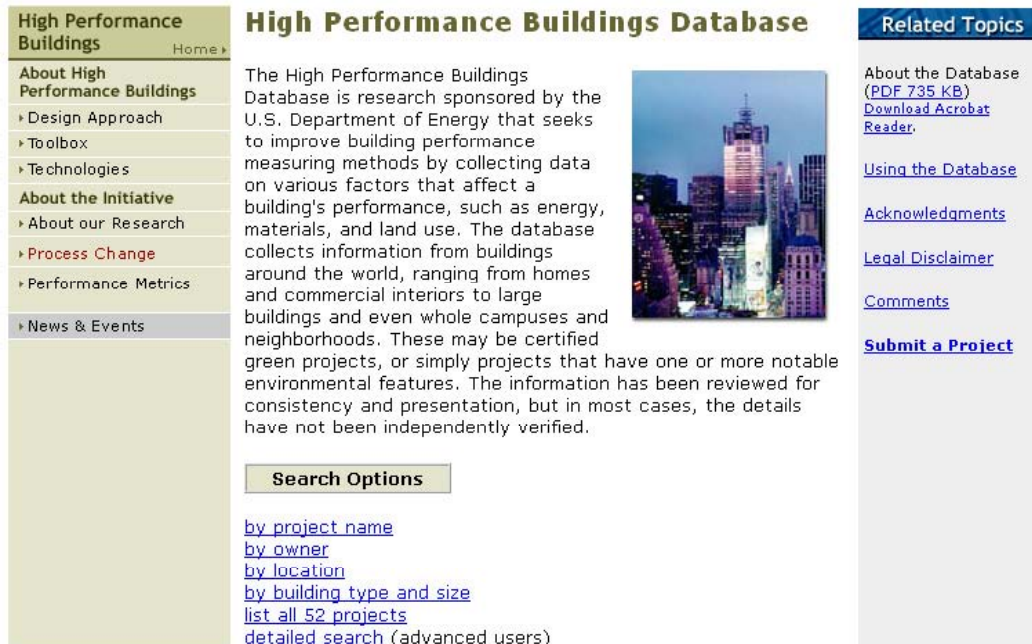
Use of the HPB Database is divided into two types of users. The first type are those looking for building information and examples. This information is useful for planning a new building, showing what technologies were used and the “lessons learned” with those technologies. In addition, design teams can use the case studies to show clients that green technologies are viable.

The second type are those who want to add information to the Database about green buildings that have been designed and constructed. This information provides exposure to the buildings and their design teams as well as building momentum for green buildings. Without case study success information, the green buildings will always remain a niche market.

Section 3 is divided into these two categories for “users” and “authors.”

**Table 1. The Twelve Case Study Topic Areas.**

<b>Topic</b>	<b>Description</b>	<b>Sample Fields</b>
Overview	General description of the building	Building location, use, and size, general overview
Process	Information about the design process and evaluation of the building	Design team members, detailed process methods as text boxes
Finance	Financial information	Construction costs, financing methods, especially of sustainable technologies
Land Use	Techniques at the community scale to minimize environmental impact	Land planning, transportation strategies
Site/Water	Techniques to minimize the impact of landscaping and water use	Site reuse, landscaping, irrigation techniques, water conservation
Energy	Energy consumption data	Utility bills, breakdown of energy end-uses, design approaches and technologies used
Materials	Material selections	Use of local materials, recycling, low-emission products
Indoor Environment	Indoor environmental quality	Access to daylighting, commissioning, low-VOC products, outside air control
Images	Photo library of images	Photos, rendering, or schematics with captions and credits
Ratings and Awards	Listing of ratings systems used for the building and awards	LEED™ rating (including credits achieved), if applicable, Green Building Challenge, list of awards received
Lessons Learned	Documentation of major successes and lessons learned from the project that can be transferred to other efforts	Text box of lessons learned
Learn More	Additional information about the project	Visiting and directions, technical papers, other publications and links to related web-sites



**Figure 1 Database Opening Screen Showing Search Capabilities.**

### 3.1 Searching the HPB Database

Once a user enters the HPB Database (see Figure 1), they have many options for searching using one of several “basic” search options (location, project name, owner, building type). Users can also try a multivariable Boolean search and additional options on the “advanced” search screen. Projects that meet the search criteria are listed by name, with owner and location. Clicking on a project name takes the user to an “Overview” section that provides a description of the project with a list of all topics areas for that project as shown in Figure 2.

A “Topics” navigation bar on the left (see Figure 3) shows the list of detailed topic areas with some highlighted and others grayed out, reflecting which topics are and are not available for this project. If more than one project meets the current search criteria, it is possible to jump from project to project using a pull-down menu at the top of each screen (see Figure 4). This navigation option allows users to browse through a list of projects while staying within a particular topic. For example, if you are interested in energy information about all buildings that met your search criteria, go to “energy” (see Figure 5) and select another building from the list at the top. The search engine will go to the energy screen for that building. Other example screens are shown in Figure 6 (thumbnail and large images) and Figure 7 (awards).

Users also can print out PDF versions of case studies for distribution, link to additional sites and publications about buildings, and contact the design team for projects.

### 3.2 Entering additional buildings

Anyone can register and submit a building case study for review and eventual publication in the HPB Database. The person submitting a case study must be able to certify that they have the

authority to release information about the building into a public venue. It is not necessary to enter data in every field, but the design and owner community will benefit most from complete data. It is also important to capture the “lessons learned,” as others can benefit tremendously from reading about what did and what did not work well. After entering the data, it can be reviewed for accuracy before submitting. Note that information can be completed in multiple sessions. Once the entry is submitted, the information is stored in the Database. Before publication, an editorial team will review the content and determine if there is sufficient information to publish the case study.

Figure 8 shows an example of an input screen. The navigation bar on the left shows the variety of input screens that are available. The report engine will sort this information and produce the case-study reports as shown in Figure 3. Note the pull-down boxes. Examples of these are unit selection and categories of inputs to standardize input types and to guide the indexing and search capabilities. It is not necessary that building construction be complete before information is entered in the database. Additional information can be added as it becomes available.

Some general guidelines:

- Use lots of photos to help tell the story about the building.
- Include information about process that would interest the design community.
- Include “lessons learned” about each topic that discuss “issues or problems” to avoid in the future and highlight ideas that worked well.
- Use generic names whenever possible. Brand names will be removed during the review process.
- Provide as much energy data as possible. Total energy consumption can be taken from utility bills. Simulation data is useful for new buildings or buildings in the design phase. Utility data should be used to replace simulation data to show actual performance after one-year of operation.
- Include the motivation behind the building and why environmentally sensitive strategies were used.

#### **4. FUTURE PLANS FOR THE HPB DATABASE**

Additional development of the HPB Database is planned to facilitate data entry, review, and publication. The development includes:

- Off-line entry such that data can be uploaded directly into the database;
- Customized front-ends and queries. For example, if an organization or agency wants to highlight specific buildings, a query and front-end can be set up to view only those projects;
- Additional building metrics on performance, especially energy.

## Zion National Park Visitor Center (Zion Visitor Center)

TOPICS
Overview
Process
Finance
Land Use
Site/Water
Energy
Materials
Indoor Environ.
Images
Ratings/Awards
Lessons
Learn More

HPB DATABASE
Home   Help

### Overview

- Location: Springdale, UT
- Building type(s): Retail, Interpretive Center, Assembly, Transportation, Park
- New construction
- 7,600 sq. ft. (710 sq. meters)
- Project scope: 1-story building
- Completed May 2000
- Related projects: [Zion Comfort Station](#) is within this project.

As a primary component of the Zion Canyon Transportation System, this low-energy, sustainable facility is the entry to a transit- and pedestrian-centered visitor experience, providing park information, interpretation and trip-planning assistance within a resource environment. The new visitor center is part of a transportation system that seeks to reduce resource impacts and enhance the visitor experience. Consisting of indoor and outdoor spaces for visitor services, this facility creates a setting to promote and interpret park resources and agency conservation values. In creating the Zion National Park Visitor Center, the National Park Service (NPS), working with DOE's National Renewable Energy Lab (NREL), has complemented Zion's natural beauty.



### Environmental Aspects

Several effective energy features were included in this project: daylighting, Trombe walls for passive solar heating, downdraft cooltowers for natural ventilation cooling, energy-efficient lighting, and advanced building controls. A roof-mounted photovoltaic (PV) system provides electric power. This project will save roughly \$14,000 and about 10 kW of electric demand per year through these energy-saving measures.

Figure 2 Example Project Overview Screen.

TOPICS
Overview
Process
Finance
Land Use
Site/Water
Energy
Materials
Indoor Environ.
Images
Ratings/Awards
Lessons
Learn More

HPB DATABASE
Home   Help

Figure 3 Project Navigation and Topics.



Go to next project on the search list...

**Figure 4 Pulldown Box for Navigating between Projects within a Topic.**

Go to next project on the search list...

### Zion Visitor Center

**TOPICS**

- › Overview
- › Process
- › Finance
- › Land Use
- › Site/Water
- › Energy
- › Materials
- › Indoor Environ.
- › Images
- › Ratings/Awards
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- › Learn More

**HPB DATABASE**

Home | Help


#### Energy

A 70% reduction in energy use was met through the design and implementation of natural ventilation, efficient lighting, effective glazing, insulation, passive downdraft cooltowers, Trombe walls, photovoltaics, energy-efficient landscaping, and an energy management system.

The roof insulation is Structural Insulated Panels (SIP's). The walls are 6-inch steel studs with a spray-in-place foam insulation.

The cooltower design was adapted from a technique used to condition outdoor patio spaces. Hot dry air is drawn into evaporative cooling pads at the top of the tower. The air is now more dense and falls naturally through the tower into the space. High windows in the building relieve the hot air.

12% of the total energy load is provided by on-site PV, with an additional 10% allowed-for in the building design.



#### Annual Energy Data

Fuel	Energy Use	End Use	Energy Use
Electricity	87,600 kWh	Heating	22,100 kWh
Natural gas	0 kWh	Cooling	2,310 kWh
Fuel oil	0 kWh	Fans & pumps	4,910 kWh
Biomass	0 kWh	Lighting	30,700 kWh
Other	0 kWh	DHW	n/a
<b>Total</b>	<b>87,600 kWh</b>	Plug loads	27,700 kWh
		Other	n/a

**Figure 5. Example Energy Screen.**

## 5. CONCLUSIONS

Specific, reliable information on high-performance green buildings is in great demand. Many organizations are collecting and publishing case studies of exemplary projects. The work required to create those case studies is being repeated unnecessarily, and project teams are inundated with repetitive requests for information.

The HPB Database supports research and development of high-performance buildings by providing a centralized clearinghouse where exhaustive information about a project can be entered by anyone connected with the project and then accessed by the building community worldwide. It also offers building professionals a tool to help improve future generations of buildings.

## **6. REFERENCES**

Energy Information Administration. 2002. "Commercial Buildings Energy Consumption Survey (CBECS)." <http://www.eia.doe.gov/emeu/cbecs/contents.html>

Building Green, Inc. 2002. "Green Building Advisor." <http://www.greenbuildingadvisor.com>

Rocky Mountain Institute. 2002. "Green Developments." <http://www.rmi.org>

## **7. ACKNOWLEDGMENTS**

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## Zion Visitor Center

**TOPICS**

- › Overview
- › Process
- › Finance
- › Land Use
- › Site/Water
- › Energy
- › Materials
- › Indoor Environ.
- › Images**
- › Ratings/Awards
- › Lessons
- › Learn More

**HPB DATABASE**

[Home](#) | [Help](#)

### Images

Please click on image thumbnails to view full-size photographs:



This photo shows the Comfort Station, a separate building for public restrooms.  
*Ed Hancock, [NREL PIX 10021](#)*



During the design of the Visitor Center, the building's cooling system and architecture were integrated through downdraft cooltowers, shown here.  
*Robb Williamson, [NREL PIX 10026](#)*



This photo shows the southern exposure of the Visitor Center, a well-suited location for Trombe walls that provide most of the building's heat as well as a 7.2 kW PV array.  
*Thomas Wood, [NREL PIX 10022](#)*



This photo shows a gathering space inside the Zion Visitor Center.  
*Robb Williamson, [NREL PIX 09231](#)*



Outdoor "rooms" for permanent displays allow for a smaller building design as well as lower capital and operation costs.  
*Robb Williamson, [NREL PIX 09224](#)*



**Figure 6 Example Images Screen.**

Go to next project on the search list...

## Zion Visitor Center

**TOPICS**

- Overview
- Process
- Finance
- Land Use
- Site/Water
- Energy
- Materials
- Indoor Environ.
- Images
- Ratings/Awards**
- Lessons
- Learn More

**HPB DATABASE**

Home | Help

### Awards

- AIA/COTE Top Ten Green Projects in 2001
- American Society of Landscape Architects Professional Awards Program in 2001; Category/title: Honor Award

◀ previous topic:  
[Images](#)

next topic: ▶  
[Lessons](#)

Figure 7 Example Awards Screen

**Project**

- Login
- Search/select

**Overview**

- General
- Scope
- Site
- Building types
- Program spaces
- Description
- Keywords

**Details**

- Process
- Project team
- Finances
- Cost data

**Performance**

- Land use & community
- Site & water
- Energy
- Materials & resources
- Indoor environment
- Key indicators
- Results
- Visuals
- Learn more

### Zion Visitor Center - General

**Identifying information**

Short project name\*  (no more than 40 characters) ?

Full project name  ?

Default units of measurement\* English ?

Project owner  ?

Owner type  ?

Project size  ft<sup>2</sup> ?

Number of stories  ?

**Project location**

Address  ?

City  State/province  ?

Zip/postal code  Country

**Occupancy**

Primary occupant type  ?

Figure 8 Example Data Entry Screen

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