



EnergyCAP System Requirements, Hosting Service, Data Security & Architecture

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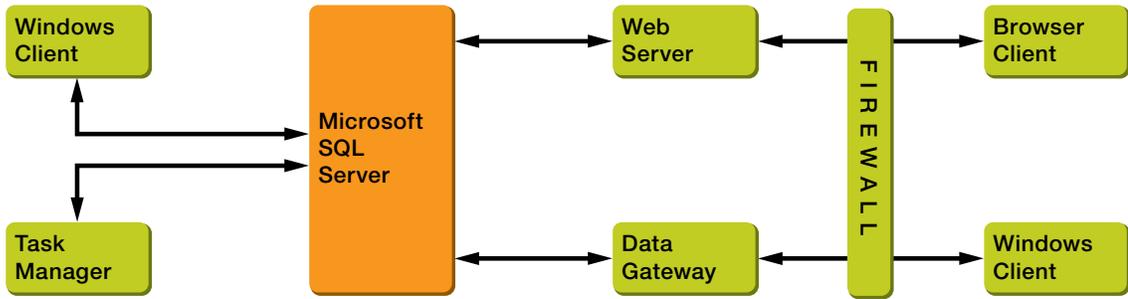
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Architecture and Deployment Options

EnergyCAP uses the powerful Microsoft SQL Server for data storage and processing, which enables the tracking of an unlimited number of bills, accounts, meters, and buildings. Host your own EnergyCAP database, or we will host it for you in our commercial datacenter.

Microsoft SQL Server

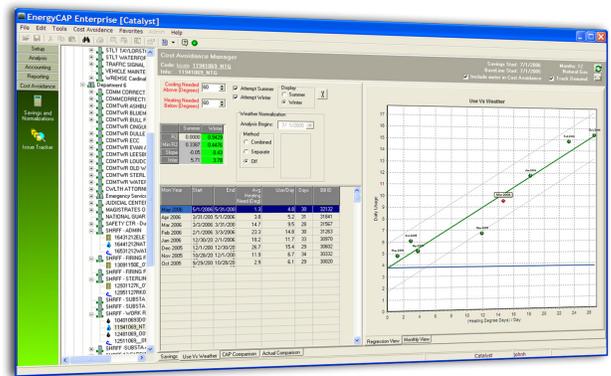


There are two client applications of EnergyCAP that connect to the database—the Web Browser Client and the Installed Windows Client. Both are used in parallel. In general the Windows Client is used by power-users and administrators.

Web Browser Client



Installed Windows Client



EnergyCAP Database Hosted By Licensee

Following are minimum system requirements for the database and web servers:

Database Server Minimum Specifications

- SQL Server 2008R2 or later
- 32 and 64 bit supported
- Local user authentication or mixed mode required

Performance Guidelines:

SQL Server performance is usually the biggest factor in a positive EnergyCAP experience. While there are many, larger documents that detail the best practices for setting up and tuning SQL Server, the most basic guidelines we can provide are as follows.

- For best performance on a server, SQL Server should be the only application running on the server, other than management utilities. Don't locate IIS or MTS server on the same server as SQL Server. Not only does this hurt SQL Server's performance, but it also makes it more difficult to performance tune and troubleshoot SQL Server.
- RAM-This is probably the most significant piece of hardware that affects SQL Server's performance. Ideally, the entire database should fit into RAM; therefore, ECI recommends installing all the RAM the server can handle. There is no such thing as too much RAM. A general rule of thumb is to maintain more RAM (if possible) than the size of your database. SQL Server will use as much RAM as possible to enhance paging and caching.
- I/O Subsystem-After RAM, the I/O subsystem is the most important piece of hardware to affect SQL Server's performance. At the very minimum, purchase hardware-based RAID for the database. As a rule of thumb, ECI recommends installing more, smaller drives, not fewer, larger drives in the array. For large, active EnergyCAP databases, the single most important I/O number to understand is IOPS on the SQL server. Our hosted environment typically reaches 7,000+ IOPS on reads to achieve the best throughput possible.
- Network Connection-At the server, have at least one 1GB network card, and it should be connected to a switch.

Hardware specifications are dependent upon database size, features utilized, and desired performance. The database server should not host any applications other than SQL.

RAID Drive Setup:

In accordance with Microsoft's suggested SQL Server setup, ECI recommends that the operating system, the log files, and the data files each exist on separate independent disk channels. Although the database server will likely perform adequately in a less optimal configuration, better performance will be realized if the basic guidelines provided below are followed. Specific organization DBAs might have other requirements or setup configurations that enhance the basic standards:

- Fewer than 1,500 meters: Xeon Dual/Quad-core, 2.0 GHz or better, 8 GB RAM, 5 GB (see below) hard drive space
- More than 1,500 and fewer than 3,000 meters: Xeon Dual/Quad Core, 2.5 GHz or better, 16 GB RAM, 10+ GB hard drive

- More than 3,000 meters: Dual Xeon processors, Dual/Quad Core, 2.5GHz or better, 32 GB RAM, 30+ GB hard drive, see above for suggested RAID configuration
- A more powerful server may be required if you have:
 - Over five years of historical bills
 - More than 50 interval data channels
 - Frequent data imports

Database Growth

Based on analyses of client databases with historical and active data, a general “rule-of-thumb” shows that an EnergyCAP database will grow at approximately 20 Kb/bill for bill data only. Therefore, the following are estimates of required storage space:

- 1000 bills/month = 12,000/year = ~240MB/year
- 2000 bills/month = 24,000/year = ~480MB/year
- 5000 bills/month = 60,000/year = ~1.2GB/year

The above estimates do not take into account additional requirements for non-bill data, such as interval channel data, complicated bill splits or virtual setup, bill images, etc. Database growth rate is determined by each licensee’s specific setup.

Web Server Minimum Specifications

- Windows 2008R2 Web/Standard/Enterprise or greater
- 4GB RAM
- Xeon Dual/Quad core, 1.6GHz or better
- ASP enabled
- .NET 4.5 or greater
- Microsoft IIS Web Server 7.5 or greater
- Port determined by web admin
- The web server can be shared with other web services or on the database server; however, network/security administration standards usually recommend not having the application/Web server running on a database server.

Note that EnergyCAP utilizes the Crystal Report Runtime engine, which may interfere with other Web applications. Although many clients have successfully installed EnergyCAP online alongside other web applications, ECI cannot be expected to resolve support issues caused by other applications running on the same server.

EnergyCAP's Hosting Service

EnergyCAP, Inc. ("ECI") offers the option of hosting Licensee's EnergyCAP database on hardware owned and maintained by ECI. Equipment is located in Pittsburgh, PA in a commercial co-location facility that has secure access, redundant high speed Internet access and redundant power supply. Details on the datacenter can be found at <https://www.expedient.com/managed-services/colocation>.

The co-location facility is an SSAE 16 certified unit. All access to the facility is by appointment only. All guests are escorted. Each room is locked using biometric and keytag/pinpad access panels. All sections are monitored with CCTVs (including parking areas), and server racks are also individually locked and can only be opened by hosting staff.

System availability over 5+ years has exceeded 99% during normal business hours. Guaranteed system availability is 98% during customary Eastern Time Zone office hours. Licensee are entitled to a credit of \$500 on the next invoice if system availability falls below 98% for the prior quarter.

ECI can store scanned copies of utility bills or other electronic files for use with EnergyCAP. If additional non-production databases are needed for testing and/or demonstration purposes, additional fees will apply.

Database Maintenance

Each Licensee's EnergyCAP database(s) will be backed up nightly to on-site and off-site locations. Because EnergyCAP is not an originator of data but a consumer, daily backups have typically been acceptable for most clients. Other arrangements can be made upon request, and may involve additional fees.

Additional operational procedures are as follows:

- The local and offsite backup software uses 448-bit Blowfish encryption for stored data.
- Symantec Endpoint Protection is installed on all Windows servers.
- Firewall and network device logs are collected to a central SysLog server. At this time, the logs are not actively mined for security anomalies.
- Data-level backups occur nightly at this time, although varied backups schedules can be accommodated as needed and may involve additional fees.
- Total hardware failure at the colocation facility (extremely unlikely) could result in an outage from four to 12 hours in duration.
- Contact EnergyCAP for specific information regarding our database recovery protocols.

- All data is located on NAS in a RAID configuration. In general hardware failure, services should be able to fail over to secondary units with an hour.
- The majority of services at colocation have a redundant secondary unit, with shared storage. If the hardware of a virtual server fails, items are restarted on secondary units. Database servers also have a secondary unit. In the case of hardware failure the secondary unit becomes the primary unit.
- SLA with the hosting location ensures that ECI is notified of all incidents within 24 hours.

Server Security

ECI's Information Technology Department, led by the Chief Information Officer, is responsible for maintaining the company's servers and the applications and operating systems on the servers:

- All applications and operating systems are patched with the latest official releases from the manufactures.
- All systems are located behind Cisco firewall equipment, with limited incoming and outgoing connections.
- Anti-virus software is installed on all servers and ECI-managed systems. The anti-virus applications are monitored by a local network server and audited daily for failure notifications.
- Anti-virus updates are pushed out daily as needed, with weekly manufacturer updates for all connected clients.
- All servers are accessed through remote connections.
- No screen savers are active; however, RDP screens lock after 10 minutes of idle time, and SSH connections to Linux servers terminate after 15 minutes of idle time.
- No automated system timeouts are currently built into the installed EnergyCAP client; however, the licensee can define the timeout period in EnergyCAP's web client.

Data Ownership & Confidentiality

Ownership of the proprietary EnergyCAP SQL database schema resides with ECI. The database schema includes: table and field design; indexes and triggers; stored procedures, scripts and views.

ECI shall treat Licensee databases as confidential information and shall not release, divulge, or provide access to data by any third parties without the prior consent of Licensee.

- The EnergyCAP application does not store or process any personal information aside from Username.

- EnergyCAP utilizes secure Web and FTP traffic as needed for implementation and other client projects.
- EnergyCAP does not encrypt database files. Communication between the installed workstation or Web application can use SSL encryption (128-bit) for all data transfer on a site-to-site basis.

EnergyCAP Installed Application

The following specifications and information apply to the installed EnergyCAP client and the web browser client.

Application Security

User authentication is required to log in to the EnergyCAP application. The authentication process uses non-reversible SHA-1 passwords:

- The EnergyCAP application is typically installed on individual workstations by an Administrator employed by the Licensee. Once installed, the application can be used by a non-administrator.
- Some configuration/INI files in the application directory need to be writable by the user for configuration changes.
- All users must have a username created in the EnergyCAP application/database. Authentication can occur against an Active Directory domain—wherein no encrypted password is stored in the DB—or through a password set and stored by the application.
- EnergyCAP uses least-privileged concept when assigning access levels. No user rights are granted initially, but must be configured individually or via a role assignment.
- Strong password requirements and password expiration dates may be enforced through the EnergyCAP application.
- No password data is transmitted in the clear for any EnergyCAP operation IF SSL is used for web communications.
- For installed applications connecting to ECI-hosted databases, the installed application uses HTTP(S) for communication. ECI honors WININET settings for proxy and such, as set through Internet Explorer.

EnergyCAP's web application, which is written in Adobe Flex, applies the user access parameters established in the installed application. The only difference between the installed and web application is that the login screen does not ask for an Active Directory domain. Instead, when the user is authenticated, EnergyCAP checks to see if the user should be authenticated against Active Directory and does so, if needed.

To accomplish authentication, the web services utilize .NET LDAP protocols to hook into Active Directory. Setup of the LDAP configuration strings are explained separately in the web application install document. Because EnergyCAP uses a configured search string, it should be

understood that the authentication page cannot search multiple domains in a forest. ECI also assumes that, if authenticating Active Directory users via the web browser, SSL will be enabled.

A session “token” is used for session authentication and timeout control. Authentication takes place server-side, and the token is required for all subsequent data exchange.

Additional notes about EnergyCAP’s web application:

- Some Flash-based client-side “cookies” are utilized to save application state.
- The application supports SSL V3 at the browser level/ IIS level if configured appropriately.
- At this time, no cookies are used for SSO.

Application Authentication

Usernames are set up inside of the EnergyCAP application. As users are created, they can either be given an EnergyCAP password which is stored as SHA-1 or be authenticated against an Active Directory domain. If the username is listed as being an Active Directory user, then that is the only way they can successfully authenticate to use the program.

Active Directory Authentication

When using EnergyCAP, there are two stages of authentication that must occur for the user to gain access to the database and begin using the program:

1. The database connection used by the EnergyCAP application is authenticated by the database server
2. The EnergyCAP application authenticates the user in the database itself

Both of these processes are now Active Directory compliant. It is assumed that Active Directory authentication, whether to the SQL server or into EnergyCAP, will only be attempted on a computer that is already trusted by the domain, ie. a computer that is joined to the domain.

Logging into EnergyCAP with an Active Directory User:

3. From the login screen, enter the username and password of the Active Directory user
4. Select the correct Datasource from the dropdown list.
5. CHECK the box labeled “Login using Active Directory”
6. Enter the domain name into the box that appears. This is not the fully

qualified domain name, but the Active Directory domain name.

7. Press **OK**.

Note: All settings except the password will be saved for the next login to speed the login process.

Database Authentication

EnergyCAP user names are stored in the SQL database. Therefore, for the login process to occur, the application must first gain access to the database and check that the username exists before determining how to authenticate the user. If enabled on the database server, the client machine can be configured to connect to the database server with NT Authentication, preventing need for a local SQL user. If Active Directory is to be used for SQL Server authentication, it must be done individually for each user, and NOT through Active Directory Groups.

Although EnergyCAP uses ADO connections for most data, ODBC connections are still required for Crystal Reports in the installed client. Because of this, EnergyCAP retrieves the database, server name and whether the connection should be treated as “Trusted” from the ODBC properties when preparing the ADO connection. Therefore, if the ODBC DSN is set to use NT Authentication, the ADO connection will follow suit.

System Requirements

LAN (installed Windows) Client:

- Windows 7 or greater
- 1024 X 768 screen resolution or better
- 1BG RAM or greater ODBC connection to the EnergyCAP database
- 32 and 64 bit supported
 - The application always runs in 32-bit mode, even if installed to a 64-bit operations system.

Web Rich (installed) Client:

- Windows 7 or greater
- 1024 X 768 screen resolution or better
- Internet connection; no ODBC
 - Port determined by the web server setup; typically Port 80

Web Browser Client:

- Adobe Flash Player 11.1 or later
- Web Browser Options

- Google Chrome
- Microsoft Internet Explorer 9 or later
- Firefox
- Safari
- 1024 x 768 screen resolution or better
- Internet connection
 - For best performance, a download speed of at least 512kb is recommended
 - Port determined by the web server setup; typically Port 80

Technology

Database Connectivity

As stated above, EnergyCAP Enterprise primarily uses ADO for its data connectivity in the GUI client. ODBC is still necessary for the Crystal Reporting engine and is also used as a fallback when ADO is not available. The database backend scripts are built and maintained using ER/Win. Minimal manual changes are required to keep both backend scripts in sync.

Data Reporting System

EnergyCAP Enterprise uses Crystal Reports to perform real-time data reporting through the Windows and Web clients. Crystal Reports is a multi-threaded reporting engine with excellent functionality and flexibility. Reports are displayed in WYSIWYG and can be printed, exported to various formats and emailed from both Windows and Web clients.

The reporting system is integrated into the Windows and Web clients. The runtime engine is installed as a component with the application.

Deployment

EnergyCAP Enterprise is designed to operate at an enterprise level, but uses technologies that allow it to scale to a single-user system.

The system is primarily LAN-based, but other technologies allow it to work over a WAN, including using the Internet as a backbone. EnergyCAP Enterprise also works well as a SaaS offering.

FAQs

Will EnergyCAP run on Citrix? If yes, for what version of Citrix are you certified and what experience do you have working with Citrix?

ECl does not currently certify Citrix; however, numerous licensees do run EnergyCAP in a Citrix environment. The only known Citrix-related issue has been user permissions to the program folder that are generally too restrictive.

Can EnergyCAP work on a locked down workstation with an auto-logged on user with limited rights? (For example, direct access to the Explorer shell would not be available to that user.)

In general, yes, although ECl has not examined this type of usage.

Do you support a test environment in addition to your production environment?

Yes

Are there any known issues with multiple sites accessing software across a WAN?

No. In some instances Remote Desktop can be used to mitigate performance issues.

What is the normal network bandwidth utilization needed for EnergyCAP?

Normal constant throughput is between 15–20 kb/sec for any given user in “lite” mode, which is used by ECl-hosted licensees.

Can we use a 9-digit number as a universal User ID for authentication?

Yes. EnergyCAP accepts userids of up to 32 characters in length.

Are there any instances where data is transferred to a third party performing a service for the Licensee?

If you use the ENERGY STAR rating service provided by EnergyCAP, then your billing and building data will be transmitted to ENERGY STAR to generate a rating.

Does EnergyCAP provide audit trail capability—the ability to track user activity, such as log-in, log-out, view data, etc.?

EnergyCAP records created and last modified IDs on most top-level objects in the database (e.g., bills, buildings, accounts, meters).