

Energy Currents

ESRI • Winter 2009

GIS for Energy

Boston Showcases Solar Power Potential with Web GIS

By Matthew DeMeritt, ESRI Writer

In 2007, Boston mayor Thomas Menino issued an executive order on climate change that set greenhouse gas reduction goals and outlined city strategies for recycling and renewable energy. That order was decisive in the formation of Solar Boston, a two-year, \$550,000 project designed to expand the use of solar power throughout the city. Solar Boston is part of the Solar America Initiative, a campaign launched by the U.S. Department of Energy (DOE) to make solar electricity cost competitive with traditional electricity production by 2015. To help meet the city's greenhouse gas reduction targets and support the goals of DOE, Menino

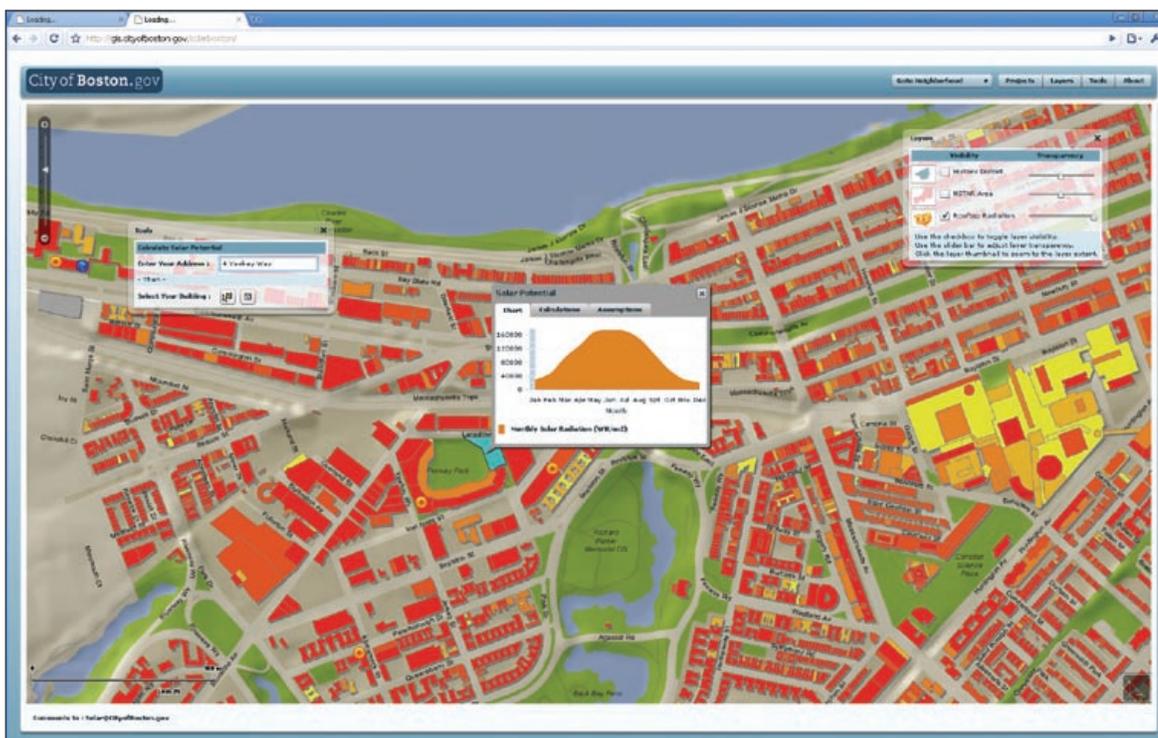
set a target of 25 megawatts of solar power to be installed by 2015. To support the Solar Boston program, Boston is using Web geographic information system (GIS) technology to map current solar installations, track progress toward the mayor's goal, and allow Bostonians to analyze their rooftop solar energy potential.

Solar Boston builds on the City of Boston's leadership in promoting green buildings, which is the practice of maximizing the use of a building's resources while reducing the environmental impact throughout its life cycle. In 2004, Menino created the Green Building Task Force,

Continued on page 9

In This Issue

ESRI News	p2
ESRI on the Road	p2
EGUG News	p4
Tools of the Trade	p5
ArcGIS and Microsoft Tools Enable Spatial Business Intelligence	
Tech Corner	p6
Data Dissemination and Visualization with Flex API	
Q&A	p8
The Role of GIS in Renewable Energy Development	
Is Renewable Energy the Impossible Dream?	p10
Map Gallery	p12
New Mexico Renewable Energy Resource Potential Map	
Enhanced Oil Recovery Revives Petroleum Fields and Reduces Greenhouse Gas Emissions	p14
Stewards of the Snake River	p16
Ethanol Buzz Fuels Planning by Colonial Pipeline Company	p18
Brazilian Utilities Sign Enterprise License Agreement with ESRI	p22
Full Range of GIS Benefits Provided to Small Utilities through ESRI's Enterprise License Agreement Program	p23



ArcGIS Cadastral Editor calculates coordinates and creates a cadastral fabric for the best-fit representation of the parcel layers.

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What's New in ArcGIS 9.3

ArcGIS 9.3 offers a complete suite of software that improves organizational workflows. With ArcGIS 9.3, users get the benefits of an established and active user community, instructor-led and online training, and new online resource centers. The resource centers offer a unified location from which users can access online help, documentation, support pages, user forums, blogs, maps, and more.

ArcGIS 9.3 comes with more tools to access data within an organization including support for Microsoft SQL Server 2008 and PostgreSQL. ArcGIS 9.3 also makes it easier to connect to and manage data from other systems via direct backward compatibility and includes new version management features, enhancements to geodatabase replication, and better geocoding. A new image service within ArcGIS Server advances an organization's data management capabilities.

ArcGIS 9.3 makes dissemination of geographic information much easier. ArcGIS Server users can now selectively build a map cache for the areas that are the most popular, and ArcGIS Server enables on-demand caching to let the map cache grow as end users access the map service. ArcGIS Server 9.3 also includes a series of JavaScript APIs for mashup-style development. The ArcGIS APIs for JavaScript take advantage of the new REST interface.

In ArcGIS 9.3, many modeling tools have been enhanced and some entirely new tools have been added. In addition, a new vehicle routing problem (VRP) solver in ArcGIS Network Analyst generates routes for fleets of vehicles.

To learn more about ArcGIS 9.3, visit www.esri.com/whatsnew.

ESRI on the Road

NRECA TechAdvantage

February 13–16, 2009
New Orleans, Louisiana
www.techadvantage.org

UEDA Winter Forum

February 23–26, 2009
St. Petersburg, Florida
www.utilityeda.com/Conferences.asp

GITA

April 19–22, 2009
Tampa, Florida
www.gita.org

WindPower 2009

May 4–7, 2009
Chicago, Illinois
www.windpowerexpo.org

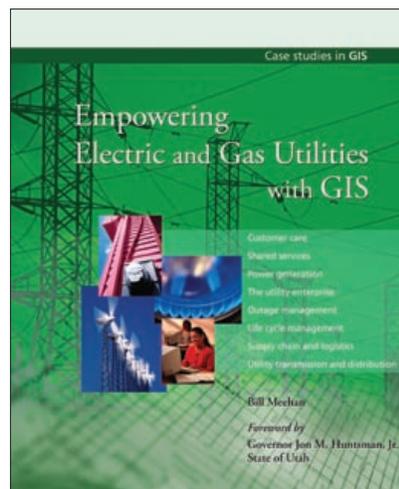
Leading Geospatial Publication Reviews ESRI Book

In *Empowering Electric and Gas Utilities with GIS*, ESRI's Bill Meehan, director of worldwide utility industry solutions, has produced a valuable text covering a range of case studies from the electric and gas sectors of the utility industry, demonstrating how application of enterprise-wide GIS can increase efficiency and improve safety.

This is a well written, easy-to-read book presenting a convincing business case for employing enterprise-wide GIS in the gas and electric utility sector in an engaging, narrative, well-illustrated style. Although it is difficult to imagine any modern utility company not already using GIS, if you know of one, make sure its directors read this book.

To order a copy of the book, visit www.esri.com/esripress.

Review provided by www.geoconnexion.com.



ESRI Canada Limited's Award of Excellence Recognizes Saint John Energy

By Amanda Graff, ESRI Canada Limited

ESRI Canada Limited, ESRI's distributor in Canada, recognized Saint John Energy of Fredericton, New Brunswick, with the Award of Excellence at the 2008 Regional User Conference. The utility was honored for its innovative and integrated approach to application deployment, which has dramatically improved efficiencies across the utility.

"Saint John Energy has proactively taken an enterprise approach to GIS that has resulted in more efficient management processes and consistency throughout the company," said Eric Melanson, ESRI Canada Limited's Atlantic regional manager. "The company has successfully transitioned from a paper-based environment and has implemented key business applications built on GIS that automate and streamline its operations."

Saint John Energy is an electricity distribution utility that serves 36,000 customers with a network of 13 substations and 84 feeders within its service area of 130 square miles. For six consecutive years, Saint John Energy was rated one of the top five utilities in Canada for

its health and safety record in the fewer-than-500-employees category as monitored by the Canadian Electricity Association.

In 2001, the utility embarked on an ambitious enterprise application project (EAP) to implement three core technologies—management, customer, and geographic information systems. The completion of this project resulted in a seamless transition from paper-based systems to an era of digital spatial data. As a first step, Saint John Energy worked with ESRI Canada Limited to create a data collection tool that would enable the utility to survey its vast infrastructure. Within one year, Saint John Energy had captured approximately 200,000 attributed submeter GPS locations. This data collection tool was used for everything from siting substations, assessing insurance claims, planning new infrastructure, and locating existing underground infrastructure.

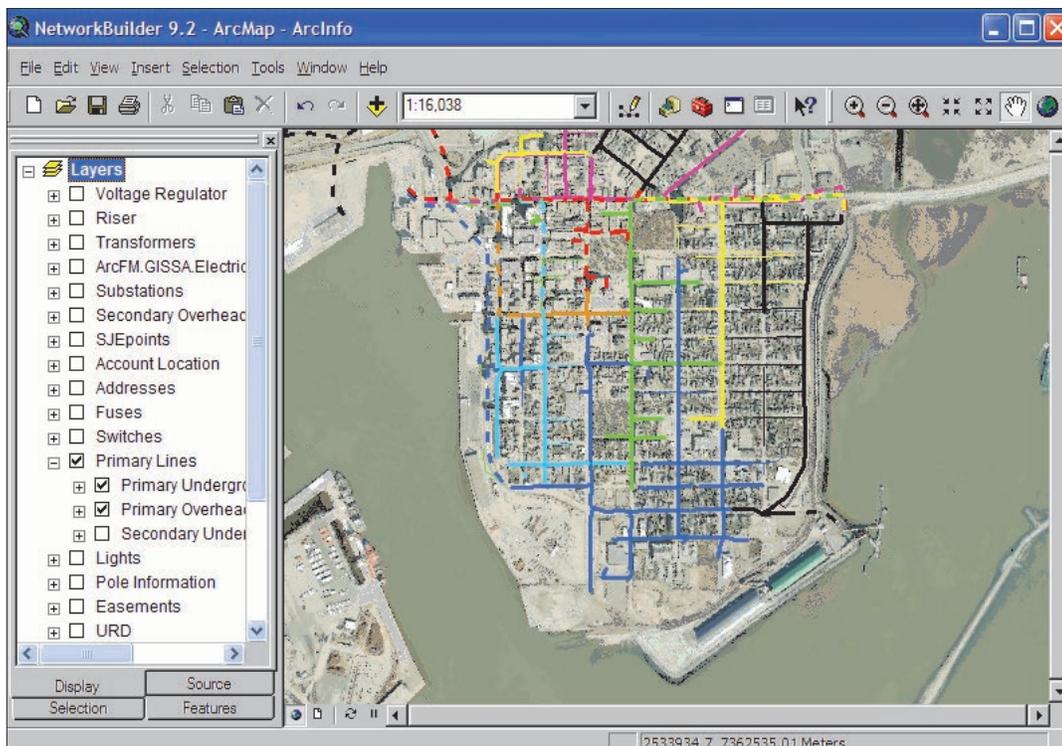
In 2006, Saint John Energy initiated a pilot project to implement automated metering infrastructure (AMI) systems that detect when a meter has experienced an outage. Upon rollout of

this project, AMI data was integrated with data from the customer information system (CIS) so that customer information could be accessed with the click of a button using ArcMap.

As part of its integration strategy from the EAP, Saint John Energy recently selected Telvent Miner & Miner's Designer application to automate the generation of cost estimates and bills for materials. Designer automatically determines the inventory that is required and performs a series of engineering calculations based on standard construction practices.

"Designer provides us with a streamlined information flow from the field to our operations, engineering, finance, and store departments," explained Bob Bernard, GIS administrator, Saint John Energy. "This will enable our field employees to perform their jobs more effectively while delivering a high-quality and consistent level of service to our customers."

For more information, visit www.esricanada.com.



This image from Saint John Energy represents feeder lines by color symbology.

2008 EGUG Conference in Review: Utilities Charged Up to Deal with Change

Seminars, speeches, and hallway conversations devoted to smart grid technology, renewable energy, and the Web at ESRI's 2008 Electric & Gas User Group (EGUG) Conference signify that utilities are preparing for big changes.

The conference, held October 19–23 in Indian Wells, California, brought together representatives from 100 utilities with ESRI industry experts and business partners. The theme, *Riding the Winds of Change*, embraced industry challenges ranging from increased regulation and renewable initiatives to outage management and online customer service. Through workshops and sessions, attendees explored how GIS technology benefits utilities in crucial

areas with spatial data management, server-based GIS, and mobile solutions.

“The general impression from utility members is that we made a lot of progress,” EGUG president Ted Kircher said. “The EGUG Conference gave utilities a renewed passion to develop broad ideas in GIS such as smart grid technology and compliance.”

Keynote speaker Clint Brown, ESRI's director of software products, emphasized the value of geographic information collected by utilities and shared ideas on how to use that data to the fullest advantage through enterprise GIS and Web 2.0.

“The new application programming in-

terfaces, or APIs, available with ArcGIS Server 9.3 provide a rapid development framework for creating, deploying, and managing enterprise mashups,” Brown said. “GIS-based services and applications can deliver portal-like access to internal information resources and enhance the accuracy and reliability of decision making as well as extend the range of what a mashup can do. Enterprise mashups reduce dependency on services that are external to the utility.”

The next EGUG Conference is set for fall 2009 in Atlanta, Georgia. For more information on EGUG and to view presentations and technology updates, visit www.esri.com/egug.



GIS users from all over the country attended the 2008 EGUG Conference.

<p>ESRI would like to thank the following EGUG sponsors.</p>	<p>Platinum Sponsor</p>	<p>Break Sponsor</p>	<p>Giveaway Sponsor</p>
			

ArcGIS and Microsoft Tools Enable Spatial Business Intelligence Enspiria Introduces ESIntial Solution for Critical Analysis and Decision Making

Enspiria Solutions recently announced its ESIntial Solution, a spatially enabled business intelligence (BI) solution that integrates ESRI's market-leading ArcGIS Server solution with key elements of Microsoft's BI tools, PerformancePoint Server and SharePoint. ESIntial was developed to provide utilities with an intelligent portal to enterprise information with a cost-effective tool that can be rapidly deployed and includes spatial information. The solution integrates and analyzes data from operations, maintenance, engineering, and financial systems with respect to key performance indicators and other relevant information needs.

The most notable benefit of ESIntial is the ability to integrate a wide variety of data sources and generate any number of perspectives of the business, saving significant IT resources and costs. Utilities can use existing Microsoft and ESRI investments for improved scalability, security, Web-based interfaces, and end-user convenience.

"ESIntial has been designed to help utilities respond quickly and cost-effectively to today's changing market conditions. We approached the design with the intention to allow easy expansion, configuration, and customization with minimal effort as utilities seek to grow their solutions and better align them with their business needs," said Mehrdod Mohseni, senior vice president and general manager at Enspiria Solutions. "This solution can be readily deployed by utilities large and small to integrate and display a range of utility-specific subjects and performance metrics as they relate to smart metering;

asset, vegetation, and outage management; field force automation; and maintenance practices."

For utilities with stand-alone deployments, ESIntial creates an environment for reporting and tracking the system usage and associated key performance indicators (KPIs). Information is delivered using a geographic view in a single, stable, nonproprietary SharePoint portal environment. As utilities establish data marts and data warehouses for asset optimization, the solution provides a nonproprietary environment to aggregate large amounts of data from separate systems, often from different departments, for an overall view of the utility.

As utilities move to a near real-time environment made possible with the implementation of a smart grid system, ESIntial enables a geographic view of current, real-time issues, outages, and load and switching data. The solution is a set of components that works to combine GIS and performance data to form a seamless view of the utility's system, accessible through a Web interface that is easy to use, query, and understand.

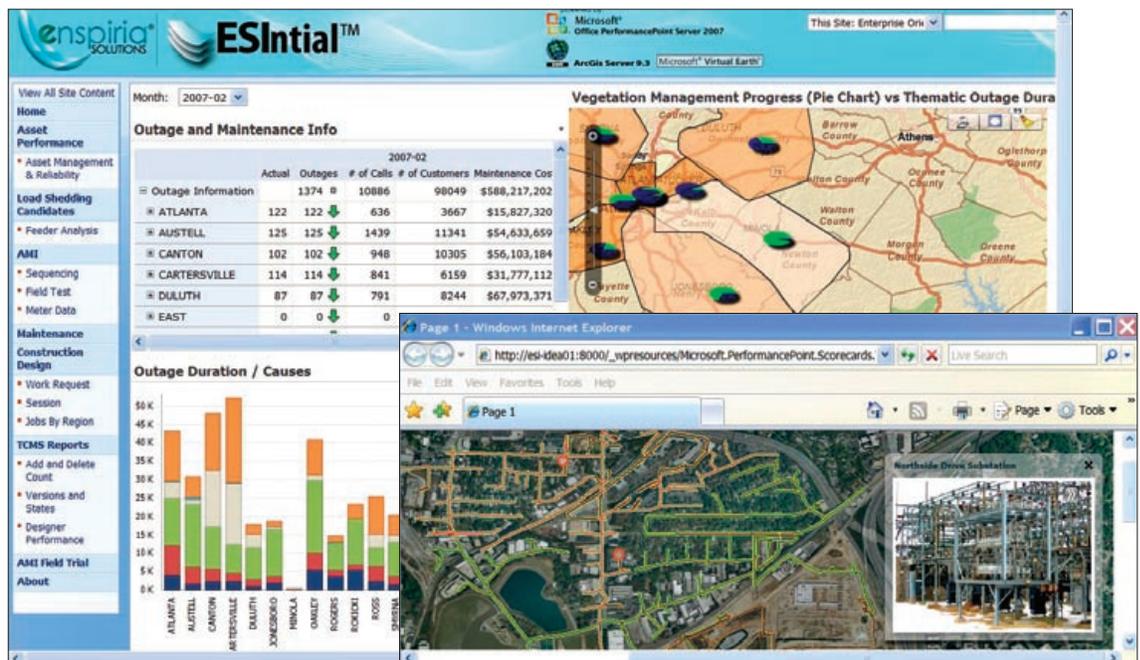
The basic software requirements needed to implement ESIntial include ESRI ArcSDE 9.2, ESRI ArcGIS Server 9.3, Microsoft SharePoint (MOSS 2007 or WSS 3.0), Microsoft PerformancePoint Server 2007, and Microsoft SQL Server 2005 with Analysis Services and Integration Services.

Enspiria has developed a four-step rapid deployment process for ESIntial, which can be achieved in a matter of weeks by taking advantage of its predefined, utility-specific applications and cubes. The architecture of ESIntial features a secure, scalable, functional, and stable environment that is designed to allow you to expand the solution based on the growing needs and requirements of your organization.

An ESRI 2008 Business Partner of the Year, Enspiria Solutions is a leading provider of consulting and systems integration services to the utility, cable, and government sectors.

For more information about Enspiria Solution's ESIntial, visit www.ESIntial.com.

For more information about ESRI's ArcGIS Server, visit www.esri.com/arcgis.



With ArcGIS technology and Enspiria's ESIntial Solution, utilities can highlight the potential impact that maintenance and asset management planning have on reliability, showing historical data from both systems in a single view.

Data Dissemination and Visualization with Flex API

By Joe Holubar, Dave Wrazien, and Pat Dolan, ESRI

Welcome to the new Tech Corner section of *Energy Currents*.

Tech Corner focuses on technical issues that address GIS data management, dissemination, visualization, and spatial analysis for the utility industry. The inaugural topic for this section is data dissemination and visualization.

Today, many utility companies are looking at streamlining the way in which they disseminate and visualize GIS data to internal and external customers in an effort to achieve greater operational awareness. The release of the ArcGIS 9.3 Flex and JavaScript software development kit (SDK) offers utility companies a way to develop and deploy rich Internet applications (RIAs) on top of ArcGIS Server 9.3 to meet these goals.

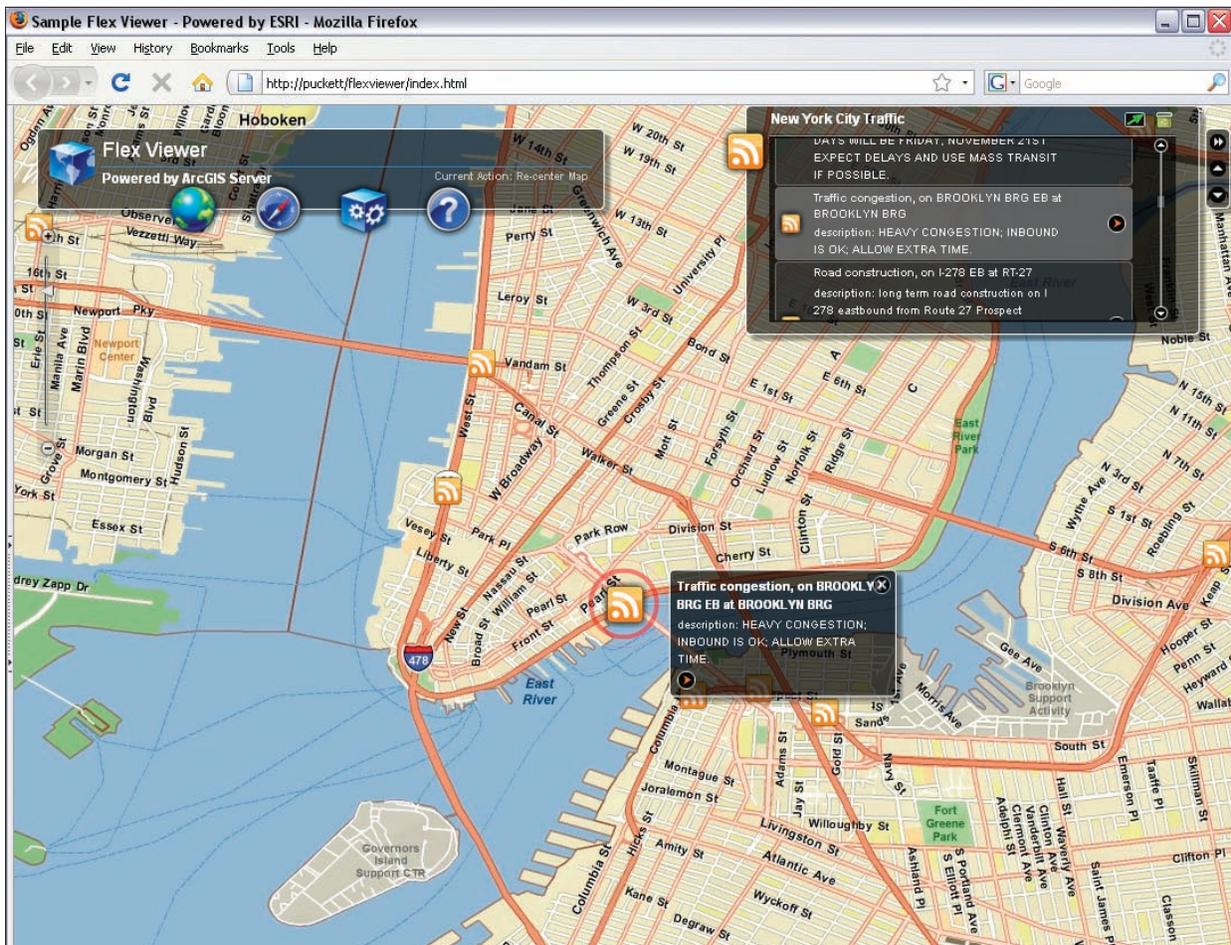
To help utilities jump-start these efforts, ESRI has released Sample Flex Viewer and JavaScript Viewer. These applications are freely available and are designed to showcase some of the core capabilities of the ArcGIS platform through a simple, modern, Web 2.0-style user interface. These applications may be used in compiled form with simple modifica-

tions to its configuration file, or its source code may be used by application developers to further explore and understand some of the best practices and programming patterns of the ArcGIS 9.3 Flex and JavaScript SDKs. This article will focus on how to access, install, and configure the Sample Flex Viewer without having to write any code.

How do I start using the sample application?

To begin using the sample application, you will need to navigate to the ESRI Resource Center at <http://resources.esri.com/arcgisserver/apis/flex/index.cfm?fa=codeGallery> to download the Sample Flex Viewer. Unzip the downloaded file and copy the folder Flex Viewer onto your Web server so that it can be accessed as a Web site or virtual directory (for example, C:\inetpub\wwwroot\FlexViewer).

After the files are copied onto the Web server, you can test the default application in a Web browser by entering the URL of the index.html page found in that directory. For example: <http://<yourservername>/FlexViewer/index.html> where “<yourservername>” is the name of your



Sample ArcGIS 9.3 Flex Viewer with the GeoRSS widget displaying the Yahoo live traffic feed.

Web server. You now should be able to access the Sample Flex Viewer application and use the navigation tools/widgets that it offers.

How do I configure the sample application with my map services?

To configure the sample application with your own map services, you'll first need to have access to a published map service based on ArcGIS Server. If you're unfamiliar with creating map services with ArcGIS Server or have questions about publishing maps, refer to ESRI's Web help at <http://webhelp.esri.com/arcgisserver/9.3/dotNet> for instructions.

Sample Flex Viewer is configured by modifying entries in an XML-based configuration file, `config.xml`, which is located in the root folder of the application directory (for example, `C:\inetpub\wwwroot\FlexViewer`). You will need to open the `config.xml` file in a standard text editing application to view and modify its contents.

Within `config.xml`, you will need to locate the XML tag `<livemaps>` and enter the following information just below that line and before the closing tag:

```
</livemaps>
<mapservice label=""<Service Name>" type="tiled" visible="false"
alpha="1">http://< Your Map Service Directory></mapservice>
```

Once complete, the configuration file should contain a section that looks something like this:

```
<livemaps>
<mapservice label="Utilities" type="dynamic" visible="false"
alpha="1">
http://puckett/ArcGIS/rest/services/Electric/MapServer
</mapservice>
...
</livemaps>
```

Once all edits have been made, be sure to save your changes. Next, open a Web browser and load (or reload) the page `http://<yourservername>/FlexViewer/index.html` to access the application with your new changes. Resting your mouse pointer on the globe icon on the menu bar will present various menu items and map services available for display such as Street Maps, Satellite Maps, and Live Maps. Clicking the Live Maps menu item will display a widget that expands to show the available live map services. Check the appropriate check box to activate your map service and have it display over the basemap.

If you want to add multiple map services to the Live Maps widget, simply copy and paste the line of text you added earlier directly below the previous line, changing the label and URL to the additional map service accordingly.

Additional Configuration: Modifying the GeoRSS Widget

Configuring widgets, for the most part, is similar to configuring the application to include your own map services. Depending on the widget and its functionality, you may or may not need to write any code. In this example, you will take a look at the out-of-the-box GeoRSS widget and modify it to display a live traffic RSS feed.

To start, navigate to the Sample Flex Viewer's widget directory: `<FlexViewer>\com\esri\solutions\flexviewer\widgets`. Widgets, like the application itself, are configurable via an XML-based file. To modify the GeoRSS widget, you will need to edit its configuration file, `GeoRSSWidget.xml`, in a text editor. You will need to change the text within the `<source>` tags. For example, you could reference a live traffic feed for New York that is being offered by Yahoo at `http://local.yahooapis.com/MapsService/rss/trafficData.xml?appid=YahooDemo&city=new+york`.

On completion, the configuration file should contain a section that looks something like this:

```
<configuration>
<source>http://local.yahooapis.com/MapsService/rss/trafficData
.xml?appid=YahooDemo&city=new+york</source>
...
</configuration>
```

Once again, be sure to save your changes to the configuration file (`GeoRSSWidget.xml`). Next, navigate to the application's `config.xml` file that you modified earlier and change the label attribute of the GeoRSS widget entry to read "New York City Traffic". It should look like this:

```
<widgets>
<widget label="New York City Traffic" icon="com/esri/solutions/
flexviewer/assets/images/icons/i_rss.png" menu="menuWidgets"
config="com/esri/solutions/flexviewer/widgets/GeoRSSWidget
.xml">com/esri/solutions/flexviewer/widgets/GeoRSSWidget
.swf</widget>
...
</widgets>
```

Save your changes to `config.xml` and refresh your Internet browser window. The GeoRSS widget will now display the traffic incidents in the New York City area.

Configuring, deploying, and using the Sample Flex Viewer is fast and easy, and it helps utilities meet many of their operational-awareness business needs. For more information about ArcGIS Server and publishing data, visit the ArcGIS Resource Center at <http://resources.esri.com/arcgisserver/index.cfm?fa=home>.

The Role of GIS in Renewable Energy Development

Q&A with Mitchell Garnett, ESRI's electric industry solutions manager

Q: Wind and solar farms are cropping up everywhere as technology makes significant strides in geothermal, biomass, and biofuel advancement. What is the role of GIS in renewable energy development?



Mitch Garnett
Electric Industry Manager

GIS is essential to renewable energy development for many reasons; the first among them is location.

Imagine the difficulty in locating

any kind of generation, particularly renewable, without following some type of geographic information system procedures. The first step in the development process is to acquire land base information about the territory that is being analyzed. Then, you can pull in historical weather information—solar patterns and solar intensities are important data. A crucial consideration that can be addressed in the GIS is sensitive areas such as Native American lands, parks, and areas of historical significance. From an economic standpoint, you want to identify existing transmission infrastructure to transport generated power to the electrical grid.

Q: Once developers have all necessary data, what is the next step?

A: The next step is analysis—where are the optimal locations for generation? That is a classic GIS problem where software systems really come into play. Land base information is typically widely available, although it may not come from a single source. There is a process of locating the necessary data, then assessing its currency and accuracy. You might find gaps in the data that will require a survey to fill in missing information. All this is necessary, though, so that the subsequent analysis is consistent.

Q: What trends do you see contributing to the collection of GIS data for renewable energy?

A: We are finding development efforts that involve many interested parties and government backing in these procedures. Typically, one interested party will look at the geography to identify sites strictly from a suitability perspective. They ask, for example, where do the terrain and wind patterns support wind generation? Simultaneously, another group will look at the same land base, trying to identify sensitive geographic areas and areas where renewable generation might work with mitigation efforts. Mitigation could entail how to position the wind turbines or where to place solar panels in accordance with special consideration for a nearby community, cultural site, or protected animal habitat.

Q: This work can be done in ArcGIS with ModelBuilder?

A: Yes. This all sounds like a complicated process, and it does require some thought to make sure that you are covering all the steps. But ArcGIS ModelBuilder allows you to capture that information and use the analysis process over and over again. After you've done it once, you can have a tool that really provides a way to accelerate the process for future analysis.

Q: Once generation is in place, what role does GIS play?

A: There is an analogous process to any new transmission construction tied to the grid that has to be done hand-in-hand with the site selection process. Around the world, we are seeing a lot of emphasis on carbon cap and trade systems. With that, GIS is going to move into a much more dynamic, almost real-time realm through integration with technical systems that are collecting volumes of operational data. We are already seeing interest in ArcGIS software-based presentation systems to highlight operational parameters and key performance indicators. These are most often called executive dashboards, or common operating pictures.

For more information on GIS for electric generation, visit www.esri.com/electric.

PODCASTS: Listen to How Others Are Gaining the Geographic Advantage

ESRI's Speaker Series offers no-cost, short audio recordings that feature GIS technology insights from GIS users, business partners, and ESRI staff. You can listen to podcasts and subscribe to automatically receive new podcasts.

To hear or download **GIS for Renewable Energy**, and other ESRI podcasts, visit www.esri.com/podcasts/speaker_series.

ESRI Training Solutions

ESRI offers many types of training for the utilities industry including instructor-led classes at ESRI facilities and client sites throughout the United States and Web courses, seminars, and workshops. Instructor-led Virtual Classroom courses include *Working with Geometric Networks for Utilities* and *Working with CAD Data in ArcGIS Desktop*. Instructor-led courses include *Working with ArcGIS Schematics* and *Working with ArcGIS Network Analyst*.

For more information, refer to ESRI's current catalog of classes, course descriptions, registration information, and pricing at www.esri.com/training. To view a schedule of free, live training seminars, visit www.esri.com/lts.

For training offered outside the United States, contact your local ESRI distributor. See www.esri.com/distributors.

Boston Showcases Solar Power Potential with Web GIS

and in 2007, based on the task force's recommendations, Boston became the first major city in the United States to require all large, private-sector buildings to conform to the Leadership in Energy and Environmental Design (LEED) green building standards. Outfitting Boston's largest residential and corporate structures with solar panels is in keeping with the city's green building and energy conservation objectives.

Renewable energy is a solution for reducing the demand on and air pollution from traditional energy systems. As on-site sources of clean power, solar energy systems can reduce greenhouse gas emissions and air pollution, increasing energy security and creating local jobs. Additionally, solar electricity systems (also called photovoltaics [PV]) have the potential to generate power when it is needed most—on hot summer days—thereby relieving strain on the electricity system and reducing the risk of blackouts. By encouraging the use of solar energy, Boston hopes to not only capture these benefits but also prepare for the market explosion likely to occur when solar power becomes competitive with fossil fuels.

To promote the use of PV to investors, Boston Redevelopment Authority (BRA) needed a system to showcase solar energy potential in

a user-friendly format—one that lets users investigate locations of interest and perform pre-processed analysis. GIS was the obvious tool to achieve this end because it started with a visual reference—a map of the entire city showing the buildings that had solar installation potential.

“We needed a baseline because you can't really get anywhere if you don't know where you are,” said Wilson Rickerson, Solar Boston coordinator. “Without GIS, we'd have no concept of the size of the city's solar industry, how fast it had grown, and what potential it had.”

GIS analysts at BRA started on the project by using ArcGIS Desktop software's ArcGIS Spatial Analyst extension to calculate the solar radiation available on building rooftops. To do this, they built a digital elevation model (DEM) of the city.

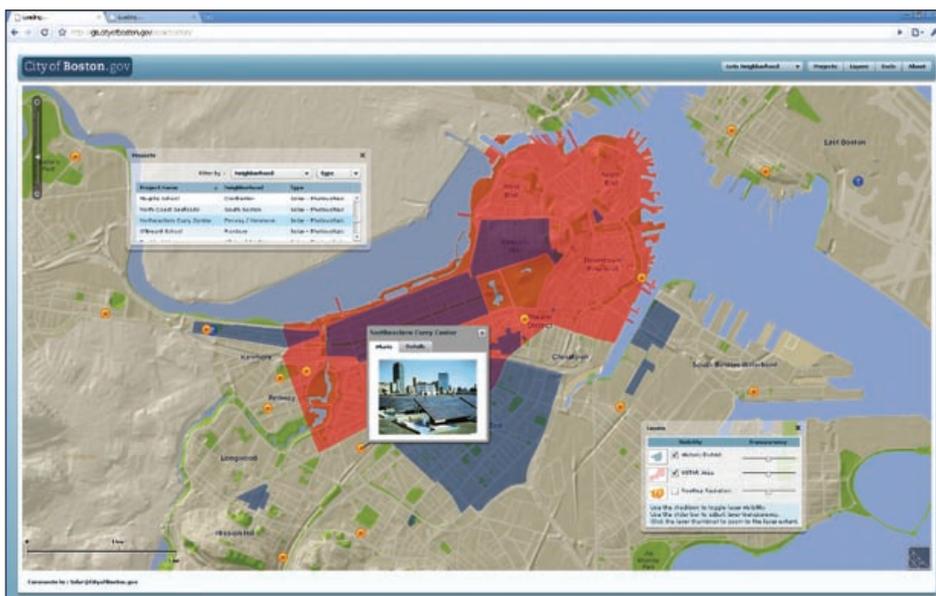
“We took the bare earth DEM and ‘burned’ into that the building heights, using attributes available in the building footprints, which resulted in a three-dimensional surface model of the city,” said Greg Knight, senior GIS applications developer with Boston Redevelopment Authority. “We proceeded with this prepared surface and utilized the solar radiation tools available in Spatial Analyst to calculate what the solar radiation availability would be for each rooftop.”

The solar radiation tools allowed the analysts to model incoming solar radiation and take into account numerous factors including variation in elevation, orientation (slope and aspect), the shadows cast by topographic features, and changes with time of day or year.

After completing the analysis in ArcGIS Desktop, the solar radiation map was published—along with a basemap, other layers of interest (e.g., historic and local electric utility districts), an address locator, and geoprocessing tools—to ArcGIS Server for use by the Solar Boston Web application. “The application was originally built using a geoprocessing service, which calculated the solar radiation on the fly,” Knight continued. “Because the calculations took about 30 seconds to complete, we preprocessed the analysis in order to deliver a more responsive Web application.”

Wrapping the analytics in an easy-to-use Web GIS application was the next step. GIS developers at BRA saw great potential in ESRI's new ArcGIS API for Flex, which is a client-side technology rendered by Flash Player 9 or Adobe AIR. Flex gives developers the ability to combine GIS-based Web services from ArcGIS Server with other Web content and display it in a fast, visually rich mapping application that can be deployed over the Web or to the desktop. It was the ideal medium to show investors the logistics of solar energy investment.

“We gathered market data to get a baseline, but we knew it was equally important to publicize the information via the Web,” said Bradford Swing, director of energy policy for Boston. “We knew Solar Boston needed a map, and this map is a simple, powerful tool to chart what we've accomplished and where we want it to go in the future.”



The ArcGIS Solar Radiation tool gives users the ability to research solar power capacity.

Is Renewable Energy the Impossible Dream?

The Science behind Tapping Wind Power Offers Insight on the Resource's Feasibility

By Jessica Wyland, ESRI Writer

"Just then, they came in sight of 30 or 40 windmills that rise from that plain. And no sooner did Don Quixote see them that he said to his squire, 'Fortune is guiding our affairs better than we ourselves could have wished. Do you see over yonder, friend Sancho, 30 or 40 hulking giants? I intend to do battle with them... With their spoils we shall begin to be rich...'"

When Miguel de Cervantes wrote of the impetuous and noble hero Don Quixote 400 years ago, he could not have imagined that one day environmental scientists and energy analysts would dream the impossible dream of stocking the electric grid with the power of the wind. Nor could he have envisioned the hulking giants that now line many a horizon, the 400-foot-tall wind turbines, each wield-

ing three 130-foot steel blades and weighing 8.5 tons. When he wrote of tilting at windmills, the Spanish literary master would not have guessed that public utilities, private companies, and investors would someday look to the wind to beat the unbeatable foes of waning fossil fuel supply and deleterious carbon emissions.

Wind energy now accounts for 1 percent of the nation's power supply, and forecasts from the U.S. Department of Energy say that figure could reach 20 percent by 2030. While wind farms crop up across the country's windiest terrains, critics point to the need for new transmission lines and the variability of the wind. Many citizens support the idea as long as it's "not in my backyard."

Despite criticism, wind power is touted as

one of the cleanest, most reliable renewable resources dreamed up so far. But is harnessing wind power on a wide scale as quixotic as "dreaming the impossible dream"?

In 2008, the United States surpassed Germany as the world's biggest generator by volume of wind energy. The amount of wind power the United States generates has doubled in the last two years, according to the American Wind Energy Association (AWEA), a trade group for wind power developers and equipment manufacturers. An investigation into the solid science of wind power facility development clarifies the potential and reliability of this blustery resource.

Twenty-eight states have set renewable energy mandates and are determined to woo wind developers. A Nebraska utility brochure boasts, "Nebraska has wind. In fact, the state ranks sixth in America for wind development." An energy company in Minnesota is announcing plans to buy an interstate transmission line and develop wind energy to replace coal-generated electricity. One county in Montana is distributing a wind map book compilation of all the data necessary to entice investors.

Harnessing the Wind

Wind turbines convert the kinetic energy in moving air into rotational energy, which in turn is converted to electricity. Humans have used wind power for centuries to move boats, grind grain, and pump water. Timeless and simple as it may seem, development of a wind power facility is much more complex than staking a pinwheel in the breeze.

"Our development teams include meteorologists, engineers, environmental permitting staff, and land agents," said Tyler Hoffbuhr, a GIS analyst with IBERDROLA RENEWABLES, the largest developer of wind power in the world.

IBERDROLA RENEWABLES has a flurry of wind power projects in the works as utilities aim to reduce dependence on nonrenewable energy. Modeling the feasibility of these proj-



The Elk River Wind Project is a 150-megawatt wind energy project located in Butler County, Kansas. Primarily used to graze cattle, the total site consists of 7,907 acres and is owned by five local landowners. Empire District Electric Company selected Elk River and entered into a 20-year agreement with IBERDROLA RENEWABLES to purchase wind energy from the facility. Empire anticipates it will purchase enough energy to meet the annual needs of about 42,000 homes. The Missouri-based utility chose to add wind energy to its portfolio for its price stability, environmental friendliness, and the economical cost for the company's customers.



The Maple Ridge Wind Farm is a 321-megawatt project spanning the New York towns of Martinsburg, Lowville, Watson, and Harrisburg, about 75 miles northeast of Syracuse. The project produces enough electricity to power up to 160,000 average New York homes. Maple Ridge has increased the amount of wind power in New York by 600 percent. New York is a state with a 25 percent Renewable Portfolio Standard designed to be in full effect by 2013.

ects requires studying location, wind speed, environmental concerns, and other variables. Wind power researchers are using technology from leading GIS developer ESRI to organize and analyze data based on geographic location. GIS is a familiar platform for engineers in the electric and gas industry as well as conservation groups, which use the technology to make decisions. Developers use GIS to organize their work as a series of layers or themes. One layer may have wind density information, while another layer will have land suitability, and another will show bird migration patterns. The layers of information, visible as colorful “smart maps,” clarify for developers the best and most efficient location for a wind farm.

“GIS enables developers of wind power facilities to reach their goal of finding the best wind areas while causing as little impact as possible to wildlife and the environment,” said Bill Meehan, director of utility solutions at ESRI. “Locating the right site can be done quickly and accurately with publicly available data and GIS technology. This fact alone speaks well for the future of wind power and green energy.”

Smart Layers for Smart Maps

The life of a wind farm project starts with a look at potential plots of land. Most developers require land within a prescribed distance of a transmission line to tie in power to the grid. If the wind is strong and steady, developers may decide to build their own transmission line. By loading utility data into the GIS, researchers can quickly see existing transmission routes and estimate the benefits of accessing existing electric lines.

Another important consideration for developers is landownership. State and county land-use data in the GIS identifies areas under development restrictions from the Bureau of Land Management and those requiring right-of-way grants. If land is privately owned, developers will have to obtain consent from individual landowners.

A layer of constraints is added to the GIS, marking areas that are environmentally protected for migratory flight paths or other animal activity. Other site restrictions apply to military bases and airports, where developers must consider radar interference and FAA regulations.

Wind data is equally crucial to researchers,

who add a resource layer to the GIS detailing wind speed and reliability. Meteorological data is continuously collected during a one- to five-year period using tower-based anemometers and vanes mounted at several height levels up to 60 meters aboveground. Wind power can be classified into density classes ranging from one (poor) to seven (excellent). For example, a wind power class of four has an average wind speed from 15.7 to 16.8 mph at a height of 50 meters aboveground. In addition to site research, meteorologists use wind data stored in the GIS to help design the layout of a wind farm by identifying wind direction, strength, and location.

Site Scouting Field Trip

“Almost all the wind power facility layouts can be done in the GIS, with maybe one or two visits to the field,” Hoffbuhr said. “Before GIS, meteorologists only had paper maps to work from, which didn’t show property ownership, wetlands, county- or state-required safety setbacks, rights-of-way, or environmental and cultural resource sites. Now we can stock the GIS with U.S. Geological Survey maps, property

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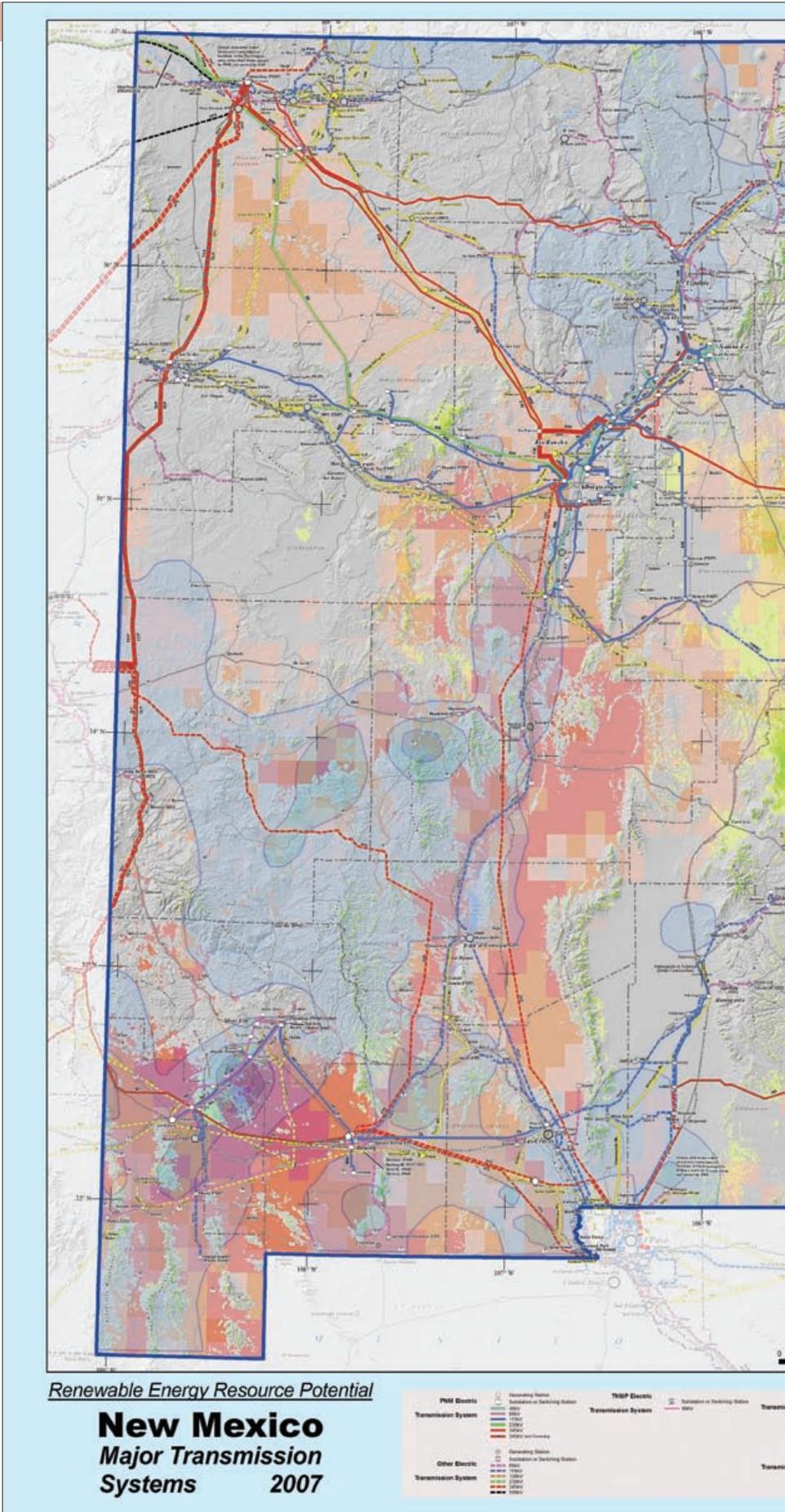
New Mexico Renewable Energy Resource Potential Map

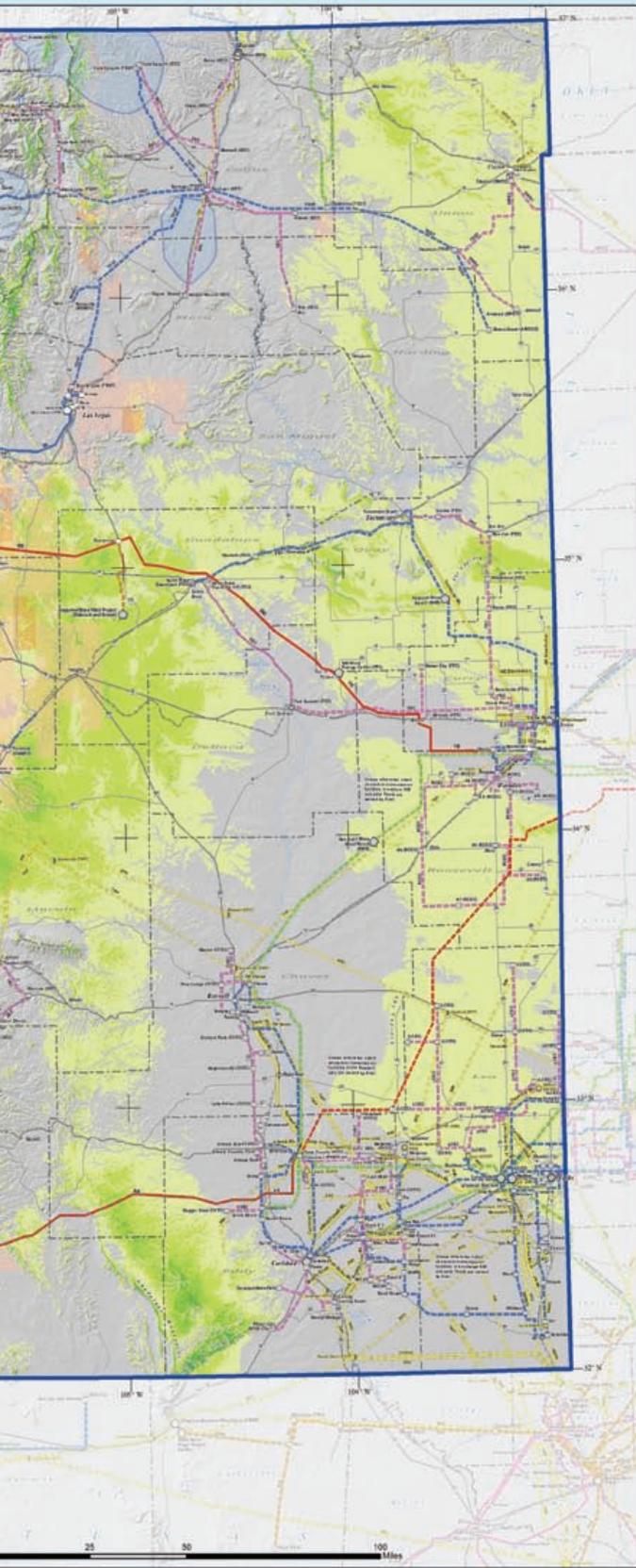
In accordance with its long-standing environmental policy to respect the land and encourage the use of sustainable resources, PNM, a New Mexico gas and electric utility, created the New Mexico Renewable Energy Resource Potential map. The map, which includes major transmission systems with tribal lands, was voted first place by peer review at the 2008 Electric & Gas User Group (EGUG) Conference Map Gallery contest.

“We created the map because we had a need to communicate the electric and natural gas transmission system’s relationship to renewable energy,” said Doug Campbell, manager of environmental planning and permitting at PNM. “GIS gives us an intuitive way to show the reader the interrelationship of New Mexico’s infrastructure and renewable resource areas. The smaller, separate maps alongside the composite map help novice map readers understand the data.”

Campbell started his project with PNM’s basemap, which shows major transmission lines, U.S. Geological Survey elevation hillshade, and Tele Atlas highway information; county, city, and town data from ESRI; and Bureau of Land Management’s Public Land Survey System township and range data. To this basemap, Campbell added wind and solar resource layers from the National Renewable Energy Lab and a geothermal layer based on a study from Southern Methodist University’s Geothermal Lab and the U.S. Department of Energy.

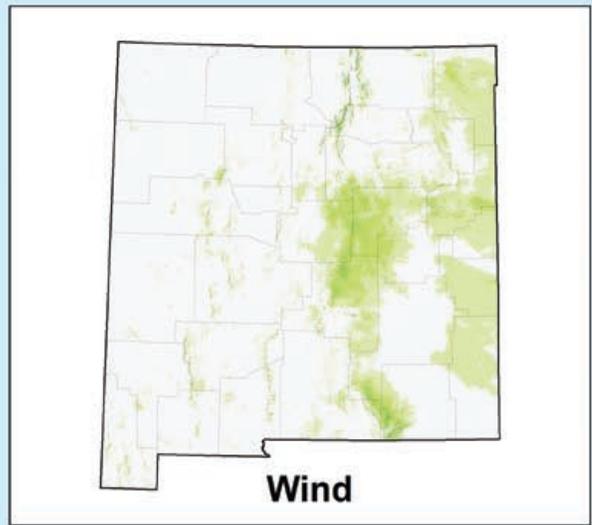
“We have used this map as a centerpoint for other discussions with federal officials working to develop the West-wide Energy Corridors, with the New Mexico Renewable Energy Transmission Authority, and with Native American partners interested in renewable energy development,” Campbell said.





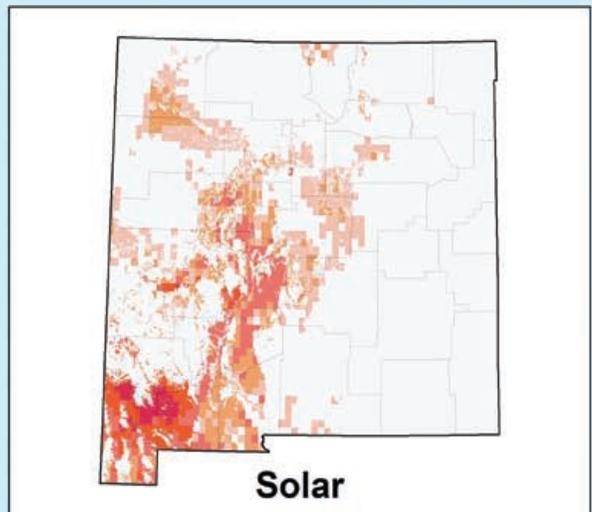
Wind Resources
 Wind Power Density at 50 meters

300 - 400 W/m ²
400 - 500 W/m ²
500 - 600 W/m ²
600 - 800 W/m ²
>800 W/m ²



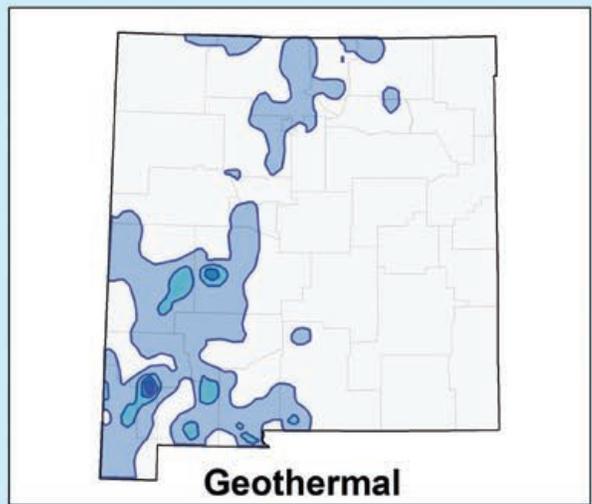
Solar Resources
 Direct Normal Irradiance (DNI)
 Solar Potential Averaged at < 1° Slope

6950 - 7050 Wh/m ² /day
7050 - 7150 Wh/m ² /day
7150 - 7250 Wh/m ² /day
7250 - 7350 Wh/m ² /day
7350 - 7483 Wh/m ² /day



Geothermal Potential
 Estimated Temp. at 2 kilometers

150 - 175 °C
175 - 200 °C
200 - 225 °C
225 - 250 °C



PNM Gas Distribution System

- Transmission Station
- High Pressure
- Transmission Pipeline
- Gas Processing Plant
- Compressor Station
- Storage
- Interconnection

Other Gas Distribution System

- Transmission Station
- High Pressure
- Transmission Pipeline
- Gas Processing Plant
- Compressor Station
- Storage
- Interconnection

Associations

Statewide Data

Legend

Scale

North Arrow



PNM
 A personal commitment to New Mexico

TNMP

PNM Resources

Enhanced Oil Recovery Revives Petroleum Fields and Reduces Greenhouse Gas Emissions

By Jessica Wyland, ESRI Writer

Carbon dioxide is not always a villain. It can actually be quite beneficial for companies like Houston-based Anadarko Petroleum Corporation, which is using the greenhouse gas for enhanced oil recovery (EOR), a process that involves injecting otherwise tapped-out wells with CO₂ to produce additional oil. CO₂ emissions that would normally be released into the atmosphere are captured, compressed, and purchased from a natural gas processing plant, then shipped via pipeline to oil fields. The CO₂ is recycled over the lifetime of these EOR projects to continue generating production from these fields.

CO₂ has breathed new life into Anadarko's Salt Creek field, a site 45 miles north of Casper, Wyoming, that invokes the kind of nostalgia associated with boomtown times in the United States. Oil was first struck at Salt Creek in the early 1900s and, at 9 miles x 5 miles, it is one of the largest oil fields in the Rocky Mountains. With more than 4,000 wells, the rich swath of

Wyoming ground has yielded about 655 million barrels of oil in its tenure. Production by conventional drilling has dwindled, but Anadarko hopes to draw at least another 150 million barrels of oil out of the field by injecting CO₂ into the ground. This pushes the oil toward predominantly previously drilled wells in the field that have been refurbished for production through EOR techniques. By using existing well bores, the company can increase production while minimizing surface disturbance.

When Anadarko initiated its EOR program in 2003 at Salt Creek, the company built a 125-mile pipeline capable of transporting 250 cubic feet of CO₂ per day from Bairoil, Wyoming, to the Salt Creek field. Anadarko expects to sequester about 700 billion cubic feet of CO₂ over the lifetime of the Salt Creek project, reducing the state's overall CO₂ emissions.

"Our primary objective is to increase oil production from the field, which is extremely

important at a time when our nation needs all forms of domestic energy resources—especially oil and natural gas, which will continue to make up the bulk of our energy supply for the foreseeable future," said Ken Michie, Anadarko's subsurface manager. "We are producing oil that's been trapped in a sandstone-type rock. As a benefit of our EOR operations, the Salt Creek field will be one of the largest CO₂ oil recovery and geologic sequestration projects of its kind in the world. We are currently using 125 million cubic feet of CO₂ per day that would otherwise be vented into the atmosphere—that's equivalent to eliminating the emissions of more than half a million cars per year."

Old Field, New Potential

While the concept of carbon sequestration for the sake of conservation is an emerging idea, the repurposing of CO₂ for enhanced oil recovery has been in practice by the oil and natural



The Salt Creek field was discovered north of Casper, Wyoming, in the early 1900s and celebrated its 100th year of production in 2008.



For more than 40 years, the Salt Creek field has been producing oil through floodwater recovery technology that utilizes pumping units, or pump jacks, to pump oil out of the ground.

gas industry for 35 years. With the evolution of related science and technology, EOR has become an increasingly efficient, safe, and practical investment.

In the United States, there are more than 13,000 EOR wells and 3,500 miles of high-pressure CO₂ pipelines, according to a 2007 report by the American Petroleum Institute (API). The report estimates that, through EOR projects, 600 million tons of CO₂ have been injected into the ground to produce about 245,000 barrels of oil per day.

The life cycle of a producing oil field, such as Salt Creek, includes several stages. Initially, oil flows naturally to the surface with existing reservoir pressure. As natural pressure drops, the reservoir is flooded with water to push out more oil. In the final stage, any remaining oil is recovered by CO₂ injection, miscible natural gas injection, or steam recovery.

“We expect CO₂ injection to keep Salt Creek Reservoir in oil production for at least 30 more years,” Michie said.

The Technology Tool

Oil companies undertaking EOR projects look forward to considerable return after great investment. Required infrastructure includes natural gas treatment facilities for CO₂ capture, pipelines, compression equipment, transportation, distribution lines, flow lines, and wells for



Low-rise wellheads replace pump jacks in the portions of the 100-year-old Salt Creek field, where Anadarko has implemented enhanced oil recovery technology that utilizes CO₂ to stimulate oil production. The CO₂ injected into the ground increases domestic oil production and prevents the greenhouse gas from being emitted into the atmosphere. As a benefit of these EOR operations, the Salt Creek field will be one of the largest CO₂ oil recovery and geologic-sequestration projects of its kind in the world.

injection. The oil, natural gas, and pipeline industries manage infrastructure and operations as meticulously as possible by using geographic information system technology. GIS links crucial data to physical locations. This gives operators an up-to-date picture for site and route planning, asset management, field crew deployment, and decision making.

“The ability to manage, correlate, predict, model, and share volumes of data in an interactive digital map makes GIS an essential analytic tool,” said Robert Brook, pipeline and gas industry manager, ESRI.

Since 1969, ESRI has worked to advance GIS technology by developing a suite of GIS software for desktop, mobile, server, and Web applications. The California-based company has more than 1 billion users around the world,

touching virtually every industry, from government and business to health and conservation.

Anadarko uses GIS from ESRI to track pipeline maintenance, view land reclamation, and keep up with revegetation of native grasses. By calling up layers on a GIS-based map, designers can look at wildlife habitat, protected species development, and archaeological sites.

“We use GIS to map every piece of infrastructure, from the flow lines and pipelines we use to move the CO₂ to our buildings and wells,” Michie said. “These wells are so old, and the survey techniques have evolved so significantly, that a lot of the old locations didn’t match. We’ve used GIS to remap those wells along with our pipes, so we know the exact locations of our pieces of infrastructure.”

Stewards of the Snake River

Idaho Power Company Studies Potential Effects of Dams on Snail Population

By Jessica Wyland, ESRI Writer

For much of Idaho the Snake River is the lifeblood. The 1,040-mile tributary of the Columbia River provides water for drinking, irrigating, and generating approximately 50 percent of the state's energy through hydropower. The Snake River flows from Yellowstone National Park through a series of mountain ranges, canyons, and plains in Wyoming, Oregon, Idaho, and Washington. For Idaho Power Company, owner and operator of 17 hydroelectric power plants, preservation of the river is of utmost importance.

Idaho Power is involved in the generation, purchase, transmission, distribution, and sale of electric energy in a 24,000-square-mile area in southern Idaho and eastern Oregon with an estimated population of 982,000. It is one of the nation's few investor-owned utilities with a predominantly hydroelectric generating base in addition to two gas-fired plants and shared ownership of three coal-fired generating plants.

"Since we use the river system for power generation and public recreation, we are committed to being good stewards of our natural resources and environment," said Mike Butler, GIS expert with Idaho Power.

Each of the 17 dams Idaho Power operates along the Snake River is subject to a federal license through the Federal Energy Regulatory Commission (FERC). Each license is for a specified term and must be renewed over time. Idaho Power is in the process of relicensing dams throughout its system and complying with new licenses received in 2004 for Bliss Dam and Lower Salmon Dam, where a study is under way to ensure the viability of the Bliss Rapids snail, a species listed as threatened under the Endangered Species Act.

When an action is likely to adversely affect any listed species, FERC is not allowed to grant licenses without a formal consultation with the U.S. Fish and Wildlife Service (USFWS).

If Idaho Power restricted operations of its Snake River Dam, the utility could potentially lose substantial revenues and would need to seek costly alternative sources of energy to meet the needs of its customers. Instead, Idaho Power takes a proactive approach to relicensing its dams by employing a large staff of experts in biology, engineering, and GIS technology. The team primarily studies and monitors hydraulic, recreational, aquatic, and terrestrial resources within the utility's service territory as defined by FERC.

Looking at Impact on Bliss Rapids Snails

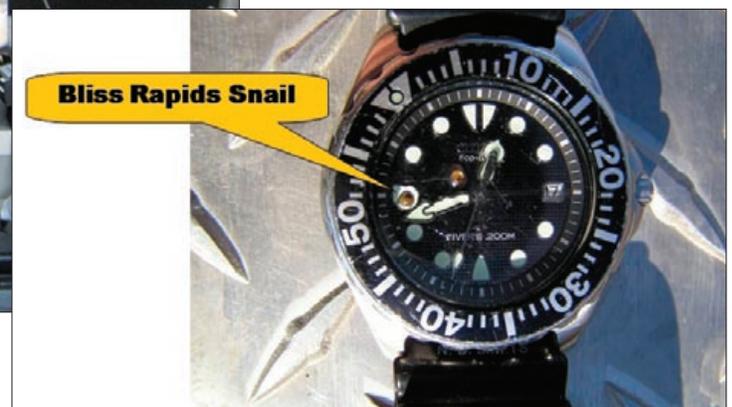
In 2004, Idaho Power began its five-year study of the Bliss Rapids snail. The gastropod may be considered an indicator species, one that defines the overall health of its habitat and the river system. Invertebrate biologists and hydraulic engineers at Idaho Power are charged with trying to locate and study habitats including the hydraulic environments of threatened or endangered snail colonies in the middle Snake River reach.

"We want to learn where and under what hydraulic and environmental conditions do we find listed snails," Butler said. "We need to be able to answer questions related to snail reactions as the water levels change during seasonal river flows and normal flow fluctuation from power generation."

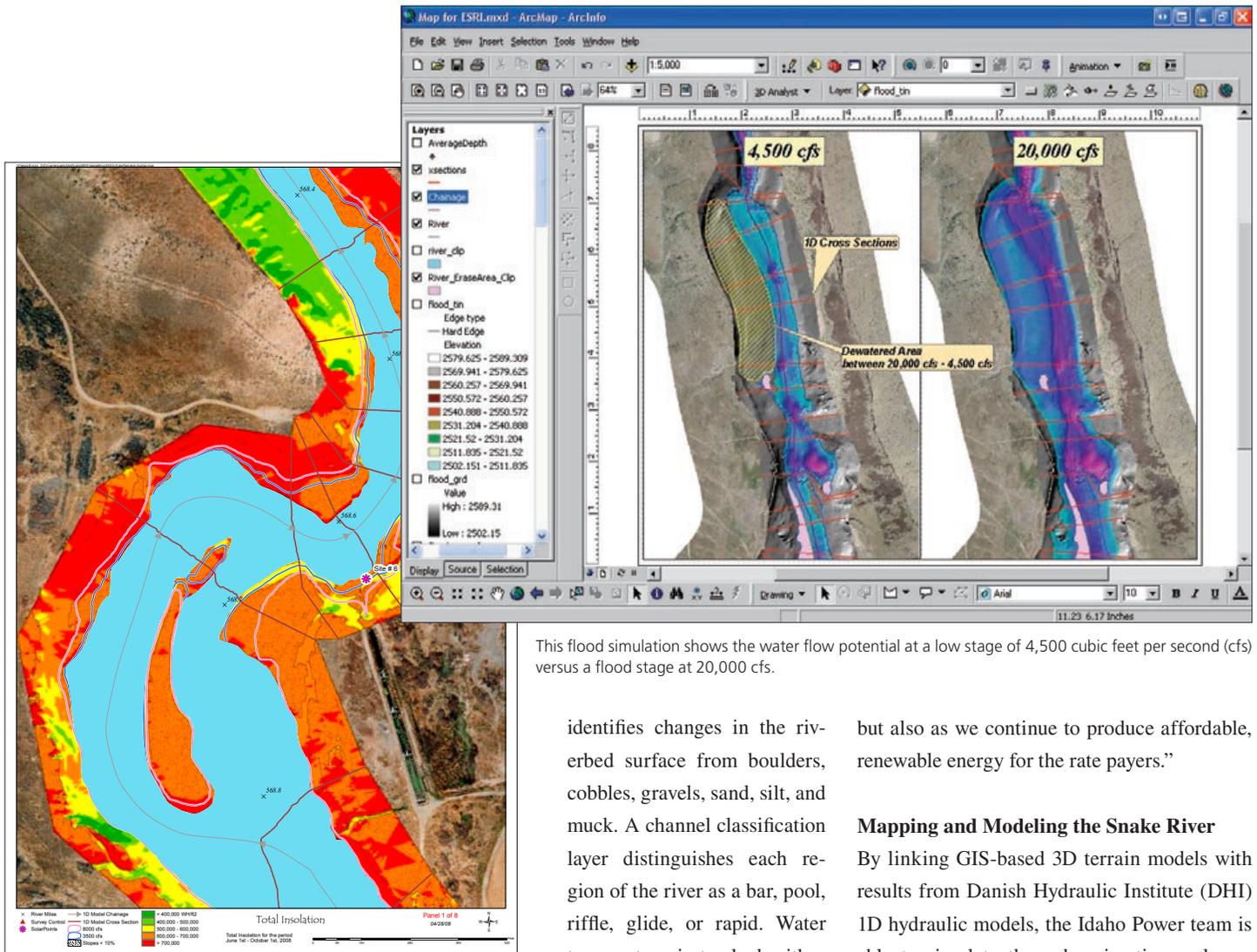
Idaho Power's team of experts had to answer



Multibeam sonar data is received inside the boat with other integrated equipment.



The Bliss Rapids snail is listed as a threatened species under the Endangered Species Act.



This flood simulation shows the water flow potential at a low stage of 4,500 cubic feet per second (cfs) versus a flood stage at 20,000 cfs.

A detailed map of the Snake River shows the effect of solar radiation on water temperature for this stretch of the river.

important questions. What are the habitats the snails occupy and what environmental conditions do they need? What hydraulic variables impact the snails? If the water level goes up or down, are the snails able to migrate to the new environment? Does the utility's operation cause harm to the snails? If so, how will the utility alter operations to minimize its impact?

"Our mission is to collect the data necessary to accurately model the river flows and locate snail habitats," Butler said. "From there, we will be able to determine how best to minimize possible operating impact to the snails—if any impact is found."

Determining Data Layers

The utility's GIS houses a comprehensive set of layers for studying the river. A substrate layer

Spatial Analyst extension help determine places on the ground within the river system where temperature changes need to be understood and monitored.

Since Bliss Rapids snails are approximately the size of a pinhead (2 to 3 mm) and, therefore, difficult to spot, the team uses Global Positioning System (GPS) technology to locate the populations. Population locations are stored in the enterprise geodatabase along with data for substrate layers, channel classification, water temperature, and water velocity.

"GIS allows us to look at the potential area of impact by flow and even duration of wetting and drying so we can try to minimize that area and simultaneously maximize operating potential," Butler said. "This is essential to our company not only during the relicensing process

but also as we continue to produce affordable, renewable energy for the rate payers."

Mapping and Modeling the Snake River

By linking GIS-based 3D terrain models with results from Danish Hydraulic Institute (DHI) 1D hydraulic models, the Idaho Power team is able to simulate through animation and portray with maps all flow regimes the company may encounter through normal operations. Researchers are able to overlay inundation polygons with known snail locations, mapped habitats, and channel classification polygons to quantify how much area of preferred snail habitats are wetted or dewatered at different operational flows.

With ESRI's ArcGIS Spatial Analyst and 3D Analyst extensions, the team created a series of triangulated irregular networks (TIN) and surface grids that combine underwater topography, aerial photogrammetry, and various ground surveys into a seamless physical representation of the riverbed. Sonar devices are used to collect underwater topography, or bathymetry. Ground surveys are conducted by engineers who map the bed and water surface elevations using sonar, real-time kinematic (RTK) GPS,

Continued on page 23

Ethanol Buzz Fuels Planning by Colonial Pipeline Company

Jessica Wyland, ESRI Writer

Amid the clamor of national debate over how best to reduce reliance on oil, the call to replace petroleum with ethanol made enough noise to attract government and industry attention.

A federal mandate, passed in December 2007, requires that the United States produce 15 billion gallons of corn-based ethanol by 2015. In response, a major U.S. pipeline company, Colonial Pipeline Company, began its study of the feasibility of introducing alternative fuels, such as ethanol, to pipeline shipments.

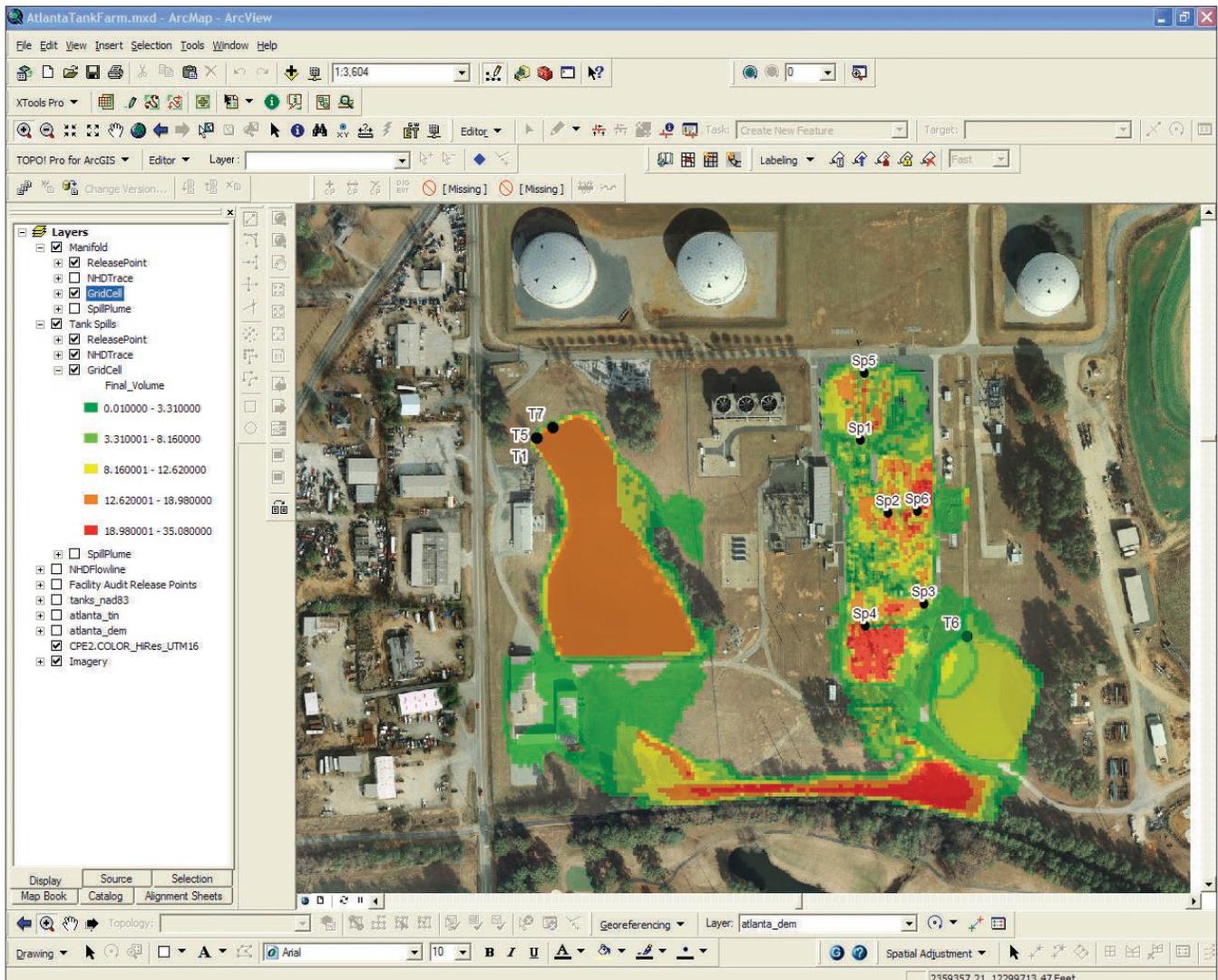
“Ethanol is now transported on railways and roads, but there is growing interest in the use of pipelines,” said Chad Zamarin, who spent eight

years in the natural gas industry working on new pipeline construction, failure investigation, and pipeline-integrity management before joining Georgia-based Colonial in 2004. “We want to be able to safely ship any and all types of fuel.”

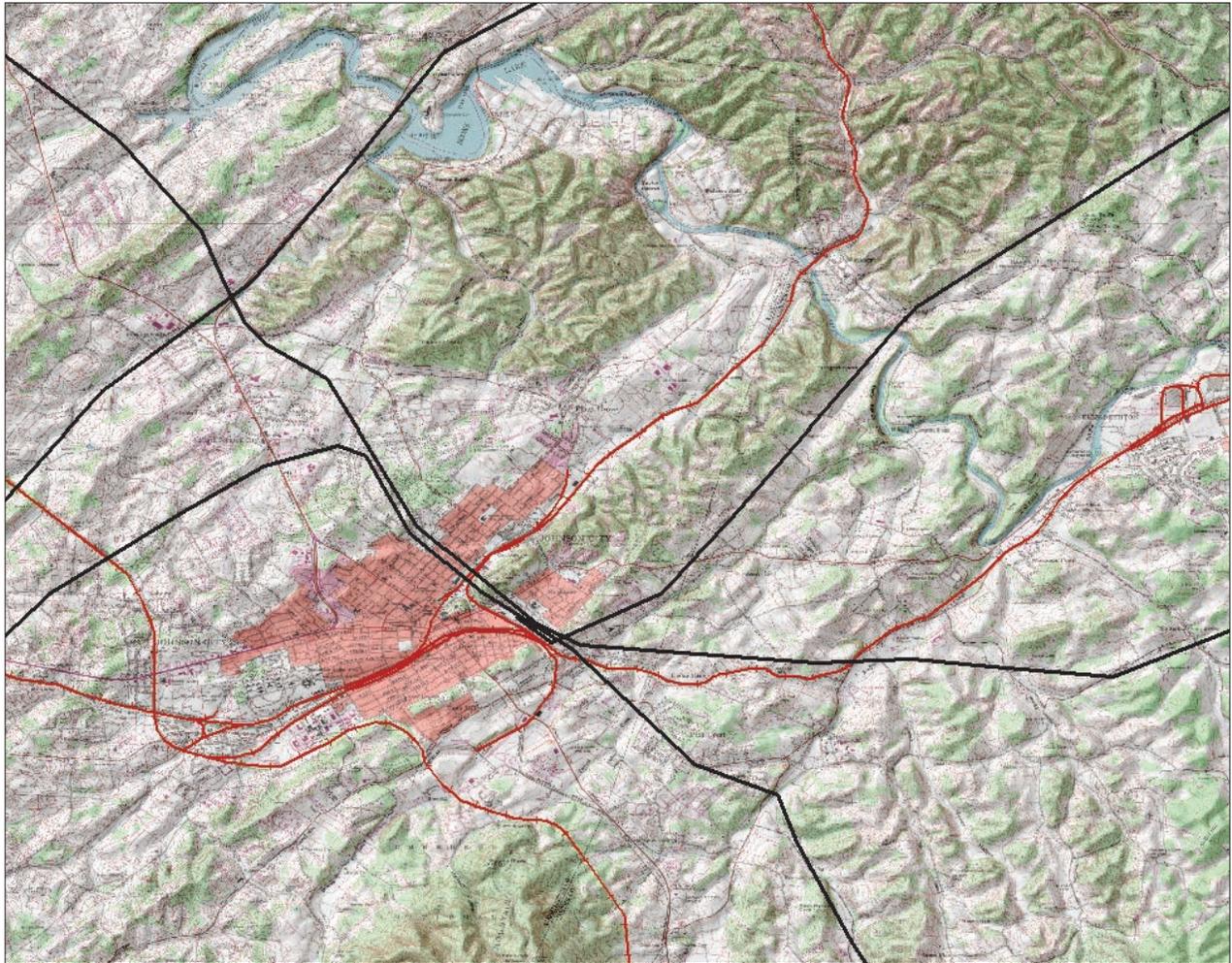
Colonial has been in the pipeline business for 45 years and delivers a daily average of 100 million gallons of different fuels to markets across the southern and eastern United States. The company’s 5,500-mile network of underground pipelines extends from Houston, Texas, to the New York harbor and carries gasoline, home heating oil, aviation fuel, and other refined petroleum products.

Even for a company with as much experience and infrastructure as Colonial, the task of shipping ethanol brings new concerns that must be addressed such as protection of the steel pipe and integrity of the fuel being shipped. Despite obstacles, Colonial is pushing ahead with system integrity and business case studies for carrying alternative fuels including biofuels.

“We are moving in the direction of alternative fuels because we want to be ready to ship not only the fuels of today but also the emerging and still unknown fuels of tomorrow,” Zamarin said. “Pipelines are by far the safest, most reliable, and most efficient mode of transportation.



This image of a refinery incorporates spatial analysis for detailed planning purposes.



This ArcMap screen shot shows the current pipeline routes with topology.

We are trying to figure out how to use our infrastructure and technology to address the nation's energy needs.”

The Challenge of Moving Ethanol

“The first step in addressing the ethanol issue was to perform an analysis of our existing pipeline system to see if we are capable of shipping ethanol,” Zamarin said.

Colonial and other pipeline industry experts have learned that ethanol is not directly compatible with existing systems. Ethanol is water soluble and prone to absorbing moisture that may accumulate in a pipeline. The addition of water to ethanol can render the ethanol unusable as fuel. Additionally, ethanol differs from petroleum-based fuels in that, in the presence of certain impurities, it can potentially cause cracking of steel pipelines. Ethanol can also have a damaging effect on a steel pipeline's equipment and seals.

A second consideration to the idea of shipping ethanol through existing pipelines is location. Ethanol production centers are mostly in the Midwest—far from consumers and not in direct reach of many existing pipelines. Ethanol would still have to be shipped to a pipeline injection facility by train, barge, or truck.

To manage the large and growing number of contingencies and considerations, Colonial uses geographic information system technology. GIS software by ESRI provides a framework for understanding every element of a particular situation based on geographic location and relationships. In the pipeline industry, GIS is used to find the best opportunities for tying producers to pipelines to terminals and, eventually, retail gas stations.

“In today's complex regulatory and operational environment, it is impossible to effectively manage a pipeline system without the use of GIS,” said Rob Brook, ESRI's pipeline

and gas industry manager. “With GIS, you can reference and integrate limitless amounts of information and arrive at the type of informed decisions necessary to ensure public safety.”

Using GIS, pipeline companies layer infrastructure data with natural resources and population information. For Colonial, GIS provides an integrated account of the company's assets and infrastructure. The system tracks the location of pipelines, tanks, equipment, and other components. With the modern geospatial tools found in ESRI's ArcGIS software, Colonial can analyze its infrastructure to quickly identify locations that may not be compatible with ethanol. By building a computer model of proposed plans, Colonial is able to identify risks and analyze the use or modification of its pipeline system for potential ethanol service.

Working with GIS technology, Colonial has been able to build business models for

Continued on page 21

Is Renewable Energy the Impossible Dream?

lines, aerial photography, and detailed topography data to see how the buildable area matches up with the wind data.”

When development teams visit a proposed location, they collect site-based data to compare with digital information and maps within the GIS. Using a mobile device equipped with a Global Positioning System (GPS) and GIS, the team is able to update data from the site and make any necessary adjustments to the facility layout.

In total, wind power facility development is about a four-year process that involves the site research and data collection as well as procurement of government permits, landowner permission, funding, and the physical resources. When the plans are ready, developers hand over the project to the construction team.

“Once all the initial research is done, construction of the wind power complex happens quickly, sometimes in four to six months,” said

Laurie Jodziewicz, manager of siting policy at wind energy trade group AWEA. “Projects under construction right now will be online and delivering energy within a year or less.”

Once a wind farm is up and running, operators continue to use GIS to help gather inspection and operational data. Since wind energy is variable, utility companies have to figure out what to do when the wind does not blow. With GIS technology, operators can model and predict how well the wind will perform in the next few hours or days and accurately match energy production with demand.

But Will It Work?

Healthy government incentives are driving much of the wind power development in the country. A report led by the Department of Energy’s National Renewable Technology Laboratory in Golden, Colorado, reiterated predictions that wind energy will claim a 20 per-

cent share of electricity production in the next 10 years. The report called the forecast “ambitious” but “feasible.”

The energy industry is already on board with more than 9,000 new wind farms under construction in the United States and nearly 20,000 existing.

“With sophisticated site development technology and incredible wind resources, wind energy is becoming increasingly valuable,” said ESRI’s utility industry expert Meehan. “We are now seeing utilities integrate wind power into the electric system to supplement fossil fuels. Wind is a cost-effective, nonpolluting energy source that will continue to be one answer to international energy concerns.”

For more information on utility GIS solutions, visit www.esri.com/electric.



Turbine blades, loaded on giant flatbed trucks, are driven to IBERDROLA’s Shiloh Wind Power Plant, a 150-megawatt facility near Rio Vista, California, in Solano County. Approximately 100 turbines are spread across about 6,800 acres of active grazing land leased from 26 local landowners. The Renewable Portfolio Standard, adopted in 2002, requires California utilities to procure 20 percent of their energy supply from renewable sources by 2017. The power from Shiloh goes to California customers through power purchase agreements to City of Palo Alto Utilities, Modesto Irrigation District, and Pacific Gas & Electric.

Ethanol Buzz Fuels Planning by Colonial Pipeline Company

shipping ethanol via pipelines. Within the business model, Colonial can weigh the costs associated with various railroads, the production capacity for each ethanol plant, and the various transit times from producer to pipeline. Colonial engineers map and model possible scenarios of transporting ethanol from producer via trains, barges, or trucks to pipelines, then terminals, and back to trucks. Concurrently, the company can analyze population data within the GIS to determine where the greatest demand for ethanol exists.

As opportunities are emerging, pipeline companies, such as Colonial, have begun route selection and planning for new pipelines. Routing of new pipelines requires consideration for property owners, water bodies, environmental issues, impact to other utilities, types of vegetation, fault lines, and topography. All this information can be represented as layers in a GIS.

“If I want to know what ethanol producers are closest to Colonial pipelines or what railway systems connect us, I’d have to use a lot of maps and I still might not figure out which combination of producer and railroad is best,” Zamarin said. “The tedious process of shuffling through paper maps and relying on manual interpretation has become an efficient process of spatial analysis when we put all the information into the GIS. We run spatial queries to identify which ethanol producers connect to railroads and then in turn connect to our pipeline and integrate that analysis into our business models to identify the best opportunity.”

The Debate over Ethanol

While Colonial prepares to respond to the demand for biofuels—ethanol or others—the discussion of U.S. ethanol policy is intensifying. For decades, the U.S. oil and natural gas industry has blended ethanol with petroleum to add octane and oxygen, which reduces certain kinds of fuel emissions.

“Without ethanol blended into gasoline, gas today would cost 50 to 60 cents more per gallon, which in turn would raise fuel costs incorporated into the price of food,” Renewable Fuels Association spokesperson Matt Hartwig



The efficiency of pipeline distribution with GIS makes new cross-country lines a viable investment.

told *U.S. News & World Report*.

In 2007, U.S. farmers harvested a little more than 13 billion bushels of corn, according to reports by the United States Department of Agriculture (USDA). Before floods overran much of the Corn Belt, this year’s projected yield was a record 14.6 billion bushels, with 3.2 billion bushels designated for ethanol and 2.35 billion bushels for export. More recent estimates lower total projected yield to 11 billion, while corn used for ethanol is expected to jump 30 percent.

New questions abound regarding the use of corn crops. Should corn be consumed, converted into fuel, fed to animals, or exported? How much of the corn now being used for ethanol is affecting food prices?

The biofuels industry faces many complex issues, but most revolve around geospatial

questions, according to Brook, who sees GIS technology as a means to solving the nation’s energy problems.

“Whether you are analyzing regional or national supply and demand, the impact of natural disasters, or transportation issues, a geographic approach to problem solving can provide many advantages,” Brook said. “Since most of the industry’s problems are geographic in nature, it seems that biofuels and GIS are beginning what should be a long and intimate relationship.”

For more information on GIS for the gas and pipeline industry, visit www.esri.com/pipeline.

Brazilian Utilities Sign Enterprise License Agreement with ESRI

Contract Ensures Access to GIS Software, Updates, Maintenance, and Support

Two major Brazilian electric distribution companies, AES Sul and AES Eletropaulo, signed an enterprise license agreement (ELA) with ESRI's Brazilian distributor Imagem Geosistemas e Comércio Ltda. The ELA will provide deployments of current ESRI GIS software for the desktop and server as well as support, training, and maintenance. Both utilities are taking advantage of this program that allows them to expand GIS technology across each company while keeping costs low.

AES Sul recently integrated its accounting data from SAP with the physical data in its GIS. ESRI's ArcGIS platform enables the development of GIS visualization and geoprocessing services that can easily be used by other platforms, such as SAP NetWeaver, to create composite applications specifically for utilities. Using ArcGIS Mobile and ArcGIS Server technologies, AES Sul field crews keep data fresh with real-time updates of work orders and customer information.

"With the integrated platform, AES Sul has the guarantee of automatic updates that in the

past were manual and not completely reliable," said Sandra Heck, GIS coordinator for AES Sul. "Asset management is conducted through a unique channel that involves access to data through the SAP and GIS environments."

AES Eletropaulo uses GIS to meet and keep its company-wide goal of more rapid response to work orders and outages. The utility recently updated its distribution maps and customer database within an ArcGIS platform.

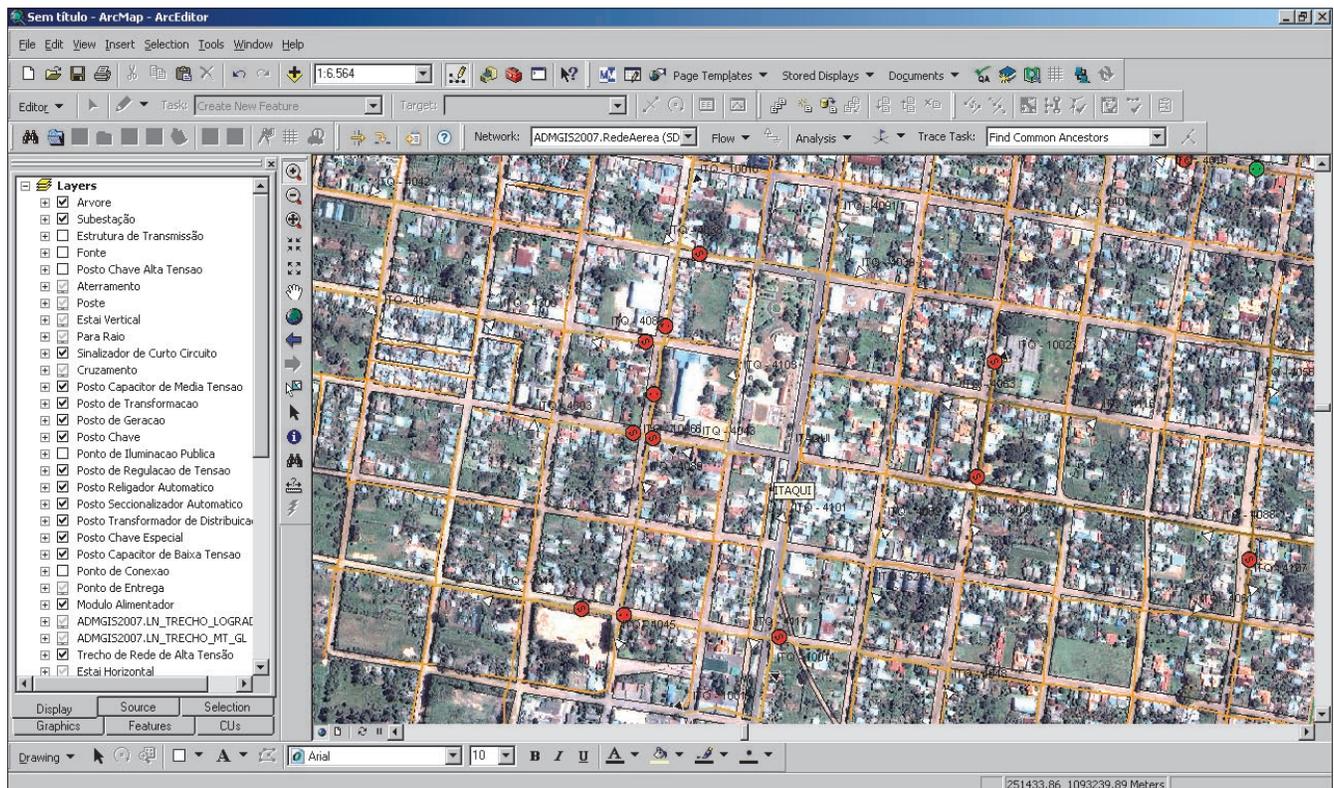
"Since implementation of enterprise GIS, we have seen marked success in the productivity and quality in our work as well as a significant reduction in operating costs," said Silvio Baldan, a business analyst with AES Eletropaulo. "We are a company with the highest level of technology related to the electric assets. It is essential for us to be aligned with international best practices, and this includes the use of GIS from ESRI."

AES Sul and AES Eletropaulo are divisions of major international power company AES. As one of the world's largest power companies, AES owns and operates a diverse and growing

portfolio of generation and distribution businesses with the capacity to serve 100 million people worldwide. AES Eletropaulo serves 6 million customers in 24 municipal districts of the metropolitan area of São Paulo. AES Sul serves 1 million consumers in the metropolitan region of Porto Alegre, the Rio Pardo and Taquari valleys, and the Central and Western Frontier regions.

"We are pleased to support AES Sul and Eletropaulo with this new agreement," said Gustavo Dias, a GIS expert with Imagem. "This ELA will save the time and money typically expended on updating GIS technology. Instead, the utilities will be able to focus on asset management, customer service, and expansion of networks."

The core technology for the ELA is ESRI's ArcGIS software, a complete system to author, serve, and use geographic information. The technology provides geographic information to those who need it, including analysts, decision makers, and field staff, through its support of mobile, Web, and desktop clients.



Example of AES Sul Electric Distribution Network in ArcGIS Desktop

Full Range of GIS Benefits Provided to Small Utilities through ESRI's Enterprise License Agreement Program

By Robert Brook, ESRI Pipeline and Gas Industry Manager

Software plays an increasingly vital role in how businesses complete their daily mission-critical activities. While software providers continue to use traditional licensing models such as the single-user license or multiple-user shared licenses, in some cases, these models no longer fully satisfy the business issues faced by many enterprises. ESRI has been working with clients to address these issues. An example of this is the new Small Utilities Enterprise License Agreement (SU-ELA) program.

The SU-ELA option is an affordable, fixed-cost licensing program that provides IT, business, and supply-chain benefits to utilities in the United States with 100,000 customers or fewer. The program offers unlimited deployments of core ArcGIS products, related maintenance, and technical support for ESRI software. In addition, it includes access to essential materials such as template solutions and standard data models.

This type of license provides significant advantages to a small utility. It allows the IT department to use standard protocols and technology to establish organization-wide standards

and consistent workflows without the costs associated with additional licenses. It facilitates the implementation of mission-critical business solutions. GIS can revolutionize more than 70 different utility processes ranging from asset and vegetation management and as-built data integration to spill assessment, outage management, and risk assessment. It removes the handcuffs most departments feel are preventing them from implementing effective solutions.

Lastly, this license option streamlines administrative requirements. The SU-ELA program simplifies the contract and budgeting process, saving utilities time and money. Procurement costs are reduced because ELAs require only one payment per year for the three-year term. Administrative costs shrink as a result of centralized coordination and management of software distribution, support, and services.

This new type of licensing is changing the way GIS is used by small utilities and allowing them to implement true enterprise systems. For more information on the SU-ELA program, visit www.esri.com/suela or call 1-800-447-9778, extension 2990.

“GIS can revolutionize more than 70 different utility processes ranging from asset and vegetation management and as-built data integration to spill assessment, outage management, and risk assessment.”

Administrative costs shrink as a result of

Continued from page 17
Stewards of the Snake River

and traditional survey techniques. Pressure transducers were also installed in the river to log water surface elevations related to discharge. The river stage data was used to calibrate several one-dimensional hydraulic models that are ultimately used to simulate water flows.

“Now we have the physical environment mapped in GIS and modeled with hydraulic modeling software,” Butler said. “We import results from our modeling work into our GIS to create inundation flood maps for specific dam discharges.”

GIS analysts at Idaho Power developed a series of Visual Basic models to streamline the flood-mapping process and geodatabase design and implementation. When the inundation polygons are compared with the channel classification and substrate layers, suitable and unsuitable snail habitats are identified for each operating flow.

“We are now able to visualize the inundation area versus discharge relationships for the entire river reach and how they relate to snail habitats,” Butler said. “Laboratory studies have determined that the snails being studied have high mortality above certain temperatures and under freezing conditions. So if we can alter operations to minimize exposing critical snail habitats to ambient air temperature and solar radiation, we can benefit the snail populations by reducing potentially harmful conditions, improve our stewardship in the river system, and still generate electricity at some of the lowest energy rates in the country.”

For more information on ESRI's ArcGIS Spatial Analyst and 3D Analyst extensions, visit www.esri.com/spatialanalyst.

Attend the Twenty-ninth Annual ESRI International User Conference

This summer, from July 13–17, thousands of professionals across the globe will travel to the San Diego Convention Center in California for the highly anticipated 29th Annual ESRI International User Conference (ESRI UC).

For more information and to register, visit www.esri.com/uc.





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