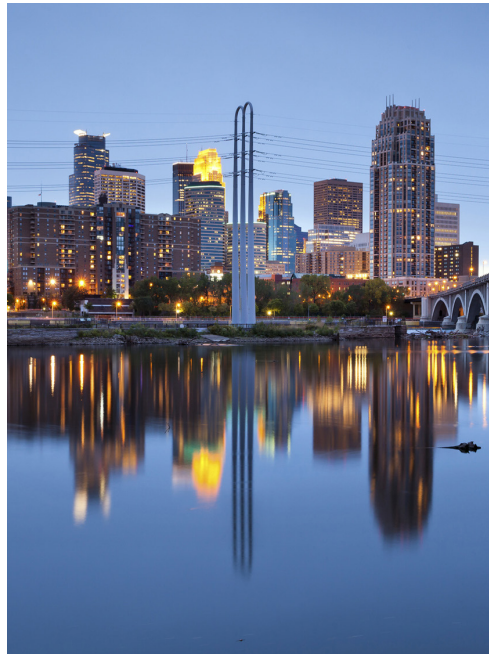National Aeronautics and Space Administration

Landsat's Critical Role in Energy

Energy is a growing necessity for people worldwide. As the demand for energy grows, Landsat plays an important role in identifying new energy sources and mitigating the human and environmental impact of energy development.

Landsat is useful in the energy sector both because of its unparalleled decades-long record of Earth's land and because of its ability to measure infrared and visible light. With more than 40 years of imagery, decision makers can monitor the environmental impact of mining and energy generation and track ecological recovery after operations end.

Landsat's ability to measure infrared light allows farmers and decision makers to gauge the health of biofuel crops and natural vegetation near dams and mining sites. The infrared and visible measurements together help energy companies identify minerals on the surface when plants are sparse.

Landsat satellites have been collecting information about the land and helping people make informed decisions on energy related topics since the 1970s.

Landsat Data for Decision-making

- Locating oil, natural gas, geothermal vents and uranium deposits
- Promoting safety through detection of coal mine fires
- Monitoring surface mines and reclamation efforts
- Managing crops dedicated to producing biofuel
- Mitigating ecological impacts from hydroelectric dams

Landsat and Energy

ABOUT LANDSAT

Landsat satellites provide an unparalleled record of Earth's varying landscapes. Landsat's 30-meter resolution is ideal for measuring human impacts on the land. The consistency of Landsat's digital image data from sensor to sensor and year to year makes it possible to trace land cover changes from 1972 to the present.

■ Locating oil, natural gas, geothermal vents, coal and uranium deposits

Many energy sources, including fossil fuels, uranium for nuclear energy, and geothermal vents for geothermal energy, come from minerals or geologic events under the Earth's surface. Landsat observations of infrared light can distinguish different minerals and geologic features on Earth's surface, which can provide clues that help identify fuel sources underground. For example in the Southwest, the U.S. Geological Survey (USGS) uses Landsat data to produce mineral classification maps that indicate the presence of geothermal systems and are used by energy companies.

■ Improving mining safety through detection of coal mine fires

Coal fires can be caused by spontaneous combustion of coal, by lightening or forest fires igniting a coal seam, or by mine-related activities like welding, electrical work or explosives. These fires can burn undetected in mine shafts releasing noxious gases that can cause asphyxiation. The fires can cause life-threatening burns and contribute to coal mine roof instability, causing mines to collapse. Landsat's thermal bands can detect hot spots near the surface that can indicate the presence of a hidden fire. Without Landsat thermal data, many of these coal mine fires would go undetected, putting miners in danger.

■ Monitoring surface mines and reclamation efforts

Landsat has collected data on mining sites for over forty years, showing what many of these landscapes looked like before, during, and after surface mining. The record helps monitor vegetative regrowth and valley filling and helps identify impacted areas.

■ Mitigating ecological impacts from hydroelectric dams

Dams that generate hydroelectric energy change the course of a river, affecting the surrounding landscape and estuaries. The Bonneville Power Administration (BPA) in Oregon used data from Landsat 7's Enhanced Thematic Mapper to classify habitats along the Columbia River Estuary. This effort helps the BPA support wildlife conservation and comply with the Endangered Species Act, while allowing hydroelectric dams to continue to operate and support energy needs.

■ Monitoring biofuel crops

Biofuel farmers use free Landsat data to identify areas of their farm that are thriving and others that are under stress. Landsat data are also used to forecast crop production, measure and manage water use, and monitor drought. Both family and commercial farmers rely on Landsat images to assess changing growing conditions.

The Hobet coal mine in West Virginia is pale tan against the dark green forest. The pale green areas near the mine are reclamation areas where plants are beginning to grow. Landsat images like this one from September 2012 are used to monitor surface mines and reclamation efforts.

Image courtesy NASA's Earth Observatory.

Further Reading

Miner Safety and Health Administration
http://www.msha.gov/

Using Remote Sensing to locate oil and gas
http://www.fas.org/irp/imint/docs/rst/Sect5/Sect5_5.html

Downstream Effects of Mountaintop Coal Mining http://www.epa.gov/region3/mtntop/pdf/downstreameffects.pdf

USDA Crop Explorer http://www.pecad.fas.usda.gov/cropexplorer/

NASA Landsat http://www.nasa.gov/landsat

Landsat Science http://landsat.gsfc.nasa.gov

USGS Landsat http://landsat.usgs.gov/

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