Natural Gas Development in Madison County, New York

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Natural gas is a fossil fuel that is derived from ancient, buried organic matter. Natural gas is a mixture of methane, ethane, propane and butane, and is found in many sedimentary rocks. For the gas to be extracted in commercially viable amounts, a source of gas, a natural reservoir system and a caprock or seal on the reservoir must all exist.

Natural gas wells have been drilled in Madison County since the late 19th century. Small fields in the Towns of Brookfield and Lebanon saw active drilling on and off from 1920 to the 1950’s. The rising price of gas and the availability of sophisticated seismic exploration methods have driven renewed exploration and development over the last decade.

The pages that follow provide basic information about the occurrence of natural gas in Madison County, focusing particularly on the fields in the Town of Lebanon, which currently produce the great majority of gas extracted in the county.
Rock strata in central New York dip gently to the southwest. This cross-section exaggerates the dip and shows the sedimentary units and their ages. The oldest rocks in New York are the 1.1 billion year old metamorphic and igneous rocks of the Adirondacks. These ancient rocks contain no oil or gas, but host ore deposits for metals such as iron, titanium, lead and zinc, and minerals such as talc, wollastonite and garnet.

The red pattern indicates rock units that may serve as reservoir beds in central and western New York. These units contain gas only where the right combination of caprock and source beds is found.
This map depicts the distribution of gas and oil fields in New York State. Virtually all of the historical development has been in the western part of the state. No oil has been recovered from wells east of the Finger Lakes region, but there is considerable potential for natural gas.

All of the oil and gas in New York is found in Paleozoic sedimentary rocks which were deposited from 520 to 300 million years ago. Most of these rocks were laid down in a sedimentary basin - the Appalachian Basin – that stretched across eastern north America from Nova Scotia to Alabama.
Most gas wells in Madison County tap reservoirs in the Oswego Sandstone. The Utica Shale that underlies the sandstone is the source bed for the gas. Minor fold structures in the sandstone help to trap the gas in commercial quantities. Wells in the Town of Lebanon are developed in a minor fold structure where the sandstone is unusually thick. The overlying Ilion Shale forms a seal on the reservoir sandstone. Wells are typically 2500-4000’ deep.

Deeper wells (greater than 10,000 feet) in the eastern Finger Lakes region have encountered large reservoirs in the Trenton-Black River Group trend. Trenton-Black River discoveries are related to deep fault structures and have proven difficult to locate, but very profitable when exploited.
Production was reported for 23 gas wells in Madison County in 2005. 19 producing wells were located in the town of Lebanon; 4 in the town of Eaton.

Gas exploration and development on private lands require that the landowner sell or lease mineral rights and access rights to their property. Landowners are strongly advised to consult a lawyer to review any contract before signing.

Modern seismic exploration involves laying out a grid of geophones (earth sound sensors) which receive sound reflections from subsurface rock layers. The sound source may be an explosive device, or more commonly ‘thumper’ trucks which use hydraulics and compressed air systems to ‘bump’ the ground.

The information from the geophone grid is then processed by high-speed computers to produce 2-D and 3-D cross-sections of subsurface structures. Advances in computer processing and software have made this sort of exploration more common over the last 15 years.
The map on the left shows the proposed routes for Vibroseis exploration in the towns of Lebanon, Smyrna and Plymouth.

Typical Seismic Section (not from the Lebanon area)

http://openlearn.open.ac.uk/file.php/2292/S278_1_022i.jpg
Drilling of a gas well requires construction of a drilling pad and access roads, and moving in and out of heavy equipment. Development of the well may involve installation of casing and cement sheath, and treatment of the producing formation to increase gas flow into the well. The above-ground equipment is not visually obtrusive; pipelines, valves and compressor facilities pose some safety risk. Properly designed and maintained wells do not offer significant environmental hazard.
Gas wells in the Town of Lebanon

Exploration and development of natural gas wells can have negative impacts on local infrastructure. Heavy drilling equipment may damage roads, culverts and bridges.

Property owners should understand the legal framework of lease agreements and carefully document all exploration and development activity that takes place on their land.

The Chenango County Farm Bureau has an informative website for property owners considering natural gas lease agreements.

(http://www.ccfbny.org/issues/oil_lease/leasing2.htm)
Gas wells in the Town of Lebanon

Landowners with producing gas wells may receive a proportion of the gas produced in addition to a royalty for the gas sold by the operator.

Landowners near a producing well may be allocated some part of the royalty depending on proximity to the well and area of land owned within a defined spacing distance.

Spacing is controlled by the characteristics of the reservoir unit, and is set legally by the NYS Department of Environmental Conservation (NYSDEC).
Gas Wells Drilled
Town of Lebanon, Madison County
1950-2006

Bruce Selleck 4/5/07
Average US January Wellhead Price of Natural Gas

Bruce Selleck 4/5/07
Natural Gas Production

- Madison County
- Town of Lebanon

MCF Natural Gas Produced

Year

Bruce Selleck 1/09/09
Value of Production*

*based on January of year average price U.S.

Taxes Assessed = ~3.2% of production value

Madison County
Town of Lebanon
Taxes Assessed
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<tr>
<th>Year</th>
<th>Madison County Production MCF</th>
<th>Madison County Value</th>
<th>Town Lebanon Production MCF</th>
<th>Town Lebanon Value</th>
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Average household consumption of gas for domestic heating (only) in 2005-06 in the Northeastern US was 74.7 MCF (costing $1299 at a delivered price of $17.39 per MCF) (from [http://www.eia.doe.gov/emeu/steo/pub/wf01.html](http://www.eia.doe.gov/emeu/steo/pub/wf01.html)).

The 244250 MCF produced in Madison County in 2006 would heat approximately 3,269 average households in the northeastern US; the delivered value of the gas produced was worth about $4,250,000.
Natural gas production in Madison County is almost entirely from the Oswego Sandstone-Herkimer Sandstone-Oneida Conglomerate interval.

While there has been much speculation about the potential for natural gas development from the Marcellus Shale, the most likely areas for development are south of Madison County, where the Marcellus is at depths great enough (>1500 feet) to assure reasonable formation pressure and reservoir integrity.

The map on the left shows areas in southern Madison and Chenango County where the Marcellus Shale unit lies at depths great enough (red color contours) for likely development. Areas with green contours have Marcellus Shale at depths less than 1500 feet.

The Utica Shale, another potential shale gas target, underlies all of Madison and Chenango County. No Utica Shale gas has yet been developed in New York or adjacent areas.
“Trenton-Black River” reservoirs may exist at greater depths beneath the current levels of Oswego-Herkimer Sandstone exploration in Madison and Chenango Counties. The Glodes Corners Field (discovered in 1991) in Tioga County has been one of the most productive natural gas fields in the Appalachian Basin. These reservoirs occur at depths of 10,000 to 12,000 feet below the surface.

Trenton-Black River reservoirs have not yet been discovered in Madison County, but may be present. A deep well drilled in the town of Stockbridge in 2005 tested a possible Trenton-Black River reservoir, but the flow of gas was not economic.