An Historical Perspective of Oil and Gas Development in PA

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Abstract

An historical perspective of oil and gas activity is paramount to understanding the scope, scale and nature of petroleum hydrocarbon development in Pennsylvania, which in turn can be used to inform and prioritize legacy well identification, location and plugging activities. Multiple Paleozoic deposits have yielded oil and gas here since “Colonel” Edwin Drake completed his well 165 years ago, although a majority of these have been completed in the first mile of our subsurface. A best estimate of the number of oil and gas wells drilled in Pennsylvania, based on historical reporting, well documents and modern database efforts is 330,000. Owing to the commonwealth’s long history of oil and gas development, it’s also important to note that the industry pre-dates modern regulations by more than a half century. As a result, the manner(s) in which Pennsylvania’s oil and gas wells were drilled, completed and ultimately abandoned and/or plugged have evolved over time.

References


An Historical Perspective of Oil and Gas Development in PA

AAPG Conference: Orphan, Abandoned, Idle, and Marginal Wells: Opportunities with Plugging, Repurposing, Carbon Credits, and More

Pittsburgh, Pennsylvania
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Today’s Focus

- Provide an historical perspective of oil and gas development in Pennsylvania
- Discuss legacy wells in terms of technical and regulatory advances over time
- Identify Survey datasets that can be used to assist with legacy well characterization
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Oil and Gas Occurrence in Pennsylvania

• Paleozoic deposits
  ➢ Pennsylvanian
  ➢ Mississippian
  ➢ Devonian
  ➢ Silurian
  ➢ Ordovician
  ➢ Cambrian
Oil and Gas Development in Pennsylvania

- Drake Well – “Drake sand” of Riceville Fm (1859)
- Pennsylvanian coalbeds (1938+)
- Mississippian and Upper Devonian sandstones (1859+)
- Upper Devonian shales (1860+)
- Middle Devonian Marcellus shale (1979+)
- Middle Devonian Oriskany Sandstone (1930+)
- Lower Devonian carbonates (1972+)
- Lower Silurian Medina Group/Tuscarora sandstones (1947+)
- Upper Ordovician Utica Shale (2010+)
- Middle Ordovician carbonates, including “Beekmantown” interval (1984+)
- Cambrian Gatesburg Formation (1964+)
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Technology and Regulatory Timeline

- Drake oil well (1859)
- Newton gas well (1872)
- First regulation of oil and gas wells; specific to plugging
- Oil and gas well regulations for well owner rights, plugging methods
- PA Act 1934 of 1937 (Clear Stream Law)
- PA Act 225 of 1955 (Gas Operations; Well Drilling, Fracture, and Coal Mining Act, Including Gas Storage Requirements)
- PA Act 225 of 1955 (Oil and Gas Conservation Law)
- Oil and Gas Act revised in 1952 (established Orphan Well Program)
- PA Act 2001 of 2010 (production reporting requirements)
- PA Act 2 of 2011 (modified Act 214)
- Modern Marcellus Shale play (Renz No. 1, Washington County, 2004)
- Secondary recovery with waterflooding (Verrano Co., 1970s)
- Hydraulic fracturing first used in PA (1952)
- Air rotary drilling first used in PA (1954)
- PA Chapter 78 regulations of 1987 (enforce 1984 Oil and Gas Act and Coal Gas Resource Coordination Act)
- First horizontal well completion (Guilla No. 3H, Washington County, 2005)
- Revisions to PA Chapter 78; Subchapters A, C, D, and E regulations (2011)
- Formal rulemaking for unconventional wells, PA Chapter 78(a) (2016)
“Spatial and Temporal Characteristics of Historical Oil and Gas Wells in Pennsylvania: Implications for New Shale Gas Resources”

<table>
<thead>
<tr>
<th></th>
<th>Oil Well Completions</th>
<th>Gas Well Completion</th>
<th>Dry Well Completions</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical Completions through 1956</td>
<td>172,750</td>
<td>11,720</td>
<td>31,936</td>
<td>216,398</td>
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<tr>
<td>PA*IRIS/WIS Completions (1957 and beyond)</td>
<td>38,732</td>
<td>63,010</td>
<td>12,412</td>
<td>114,154</td>
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<tr>
<td>Total Completions</td>
<td>211,482</td>
<td>74,730</td>
<td>44,348</td>
<td>330,560</td>
</tr>
</tbody>
</table>

Table 1. Summary of Pennsylvania well completions based on historical and modern digital records (from Dilmore et al., 2015)
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Pertinent Datasets for Legacy Well Considerations

- **PA-GEODE** - https://maps.dcnr.pa.gov/pageode/
- https://www.dcnr.pa.gov/Geology/Pages/default.aspx
“Pennsylvania Oilfield”

- OFOG 15-01.2
- Farmline map archive
- PAGS Special bulletins
- USGS geologic folios
PA’s Exploration and Development Information Network

**DOCUMENTS**
- Location Plats
- Directional Survey Reports
- Completion Reports (comprised of well record and completion report forms)
- Frac Fluid Composition Reports
- Geophysical Logs
- Sample Studies
- Operations Documents
- Inactive Well Status Reports
- Plugging Certificates
- Historical well cards (pre-permitting, late 1800s through the early 1900s)

**DIGITAL DATA**
- Well location information (latitude, longitude, county, municipality and quadrangle)
- Well ownership and status
- Drilling, completion and well construction details
- Drillers’ logs of formations encountered while drilling
- Information interpreted by geologists (e.g., well type; formation encountered at well’s total depth; producing formation(s); field and pool associations, including natural gas storage fields)
- Geologists’ interpretations of subsurface geology (“formation picks”) from geophysical log data
- Oil, gas and waste production data (archived from DEP’s OGRE)
Thank you

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