Well Population Count

September 13, 2012

*This presentation contains minor corrections to slides presented at the workshop.*
Background

Well population activity data are broken into
  • Associated gas wells (oil wells that produce natural gas)
  • Non-associated gas wells (natural gas wells)
    o Non-associated gas wells with hydraulic fracturing
    o Non-associated gas wells without hydraulic fracturing

Many emission factors are applied at the NEMS region level so activity data is also broken out by NEMS region
  • Texas and New Mexico are only states with multiple NEMS regions

Well population activity data are inputs to calculations of emissions for most activities/equipment in the natural gas production stage (e.g. field separation equipment, well drilling, gas well workovers with hydraulic fracturing, liquids unloading, etc.)
Current Data Sources

National Data Sources:
• API’s *Basic Petroleum Data Book* for producing oil wells from 1990 to 2004
• EIA data for producing gas wells from 1990 to 2003
• *World Oil Magazine* for producing oil and gas wells from 2004 to 2010

State Data Sources:
• New Mexico and Texas county-level data
  – Used for separating state-wide production into NEMS Regions
• Colorado, Kansas, Montana, Oklahoma, Utah, Wyoming state data
  – Used for identifying count of producing coal bed methane (CBM) wells
• Texas state data
  – Used for identifying count of Barnett shale wells
Associated gas wells
(Oil wells that produce natural gas)

Step 1. Calculate by State
\[ \text{# of Associated Gas Wells by State} = \text{# of Oil Wells in State} \times \% \text{ of Oil Wells with Associated Gas by State} \]

- \# of Oil Wells in State data from API and World Oil Magazine
- \% of Oil Wells with Associated Gas by State accounts for proportion of oil wells that produce gas
  - 54.7% for Illinois, Indiana, and Michigan
  - 46.1% for all other states
  - From IPAA 1996 Oil & Gas Producing Industry in Your State Report

Step 2. Sum State Well Data for Each NEMS Region
\[ \text{# of Associated Gas Wells in NEMS Region } X = \sum \text{ Associated Gas Wells in State in NEMS Region } X^* \]

*For Texas and New Mexico, use county oil well data to break out state data into NEMS region*
Non-Associated gas wells
(Gas wells)

Step 1. Calculate by State

# of Non-Associated Gas Wells by State = # of Gas Wells in State
  • # of Gas Wells in State data from EIA and World Oil Magazine

Step 2. Sum State Well Data for Each NEMS Region

# of Non-Associated Gas Wells in NEMS Region $X = \sum$ Non-Associated Gas Wells in State in NEMS Region $X$

*For Texas and New Mexico, use county oil well data to break out state data into NEMS region*
Gas Wells with Hydraulic Fracturing

Step 1. Calculate by State

# of Gas Wells with Hydraulic Fracturing (HF) by State = # of CBM or Shale Gas Wells in State

- No available national-level data to directly identify gas wells with hydraulic fracturing
- Inventory assumption that all wells in unconventional formations (CBM, shale) are hydraulically fractured
  - Used available state-specific data for Colorado, Kansas, Montana, Oklahoma, Texas, Utah, and Wyoming (includes CBM and Barnett Shale only)
  - No data available for tight sands using current Inventory data sources
  - Data not available for all gas producing states

Step 2. Sum State Well Data for Each NEMS Region

# of Gas Wells with HF in NEMS Region X = \( \sum \) Gas Wells with HF in States in NEMS Region X*

*For Texas and New Mexico, use county oil well data to break out state data into NEMS region
Updates Under Consideration: Potential Methodology with DI Desktop®

Additional nation-wide databases are available that include well data from state oil and gas commissions or other government entities

- **One example is DI Desktop® (formerly HPDI®)**
  - Contains data on producing wells, allows direct count of wells each year
  - Contains information on reservoir type to allow more accurate count of unconventional wells
  - Amount of data available for each state varies; data not available for Indiana, Illinois

- **Population Count of Associated Gas Wells in DI Desktop®**
  - Include oil or oil and gas production wells that reported oil and gas production for each year of activity data

- **Population Count of Non-Associated Gas Wells in DI Desktop®**
  - Include gas production wells that reported gas production
  - Include oil or oil and gas production wells that did not report oil production, but reported gas production

- **Population Count of Gas Wells with Hydraulic Fracturing in DI Desktop®**
  - Begin with non-associated gas wells
  - Include wells that are horizontally drilled, assuming all horizontally drilled wells are hydraulically fractured
  - Include wells that are not horizontally drilled that are in CBM, shale, or tight gas reservoirs using a crosswalk from EIA data
### Updates Under Consideration: Potential Methodology with DI Desktop®

Comparison of Current and Potential Methodology for Well Populations

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2000</th>
<th>2010</th>
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<tbody>
<tr>
<td><strong>Associated Gas Wells</strong></td>
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<tr>
<td>2012 Inventory</td>
<td>272,678</td>
<td>246,700</td>
<td>245,309</td>
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<td>DI Desktop®</td>
<td>183,608</td>
<td>149,926</td>
<td>189,083</td>
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<td><strong>Non-Associated Gas Wells (total, includes wells with and without hydraulic fracturing)</strong></td>
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<td></td>
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<tr>
<td>2012 Inventory</td>
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<td>DI Desktop®</td>
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<td>324,992</td>
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<td><strong>Gas Wells with Hydraulic Fracturing</strong></td>
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<tr>
<td>2012 Inventory</td>
<td>232</td>
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<td>43,842</td>
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Questions for Stakeholders

• Are other sources of data available for well population count?
  – Is data available for states that are not included in the nationwide databases (e.g., Indiana, Illinois)?

• Are all wells in unconventional (shale, CBM, tight sands) formations hydraulically fractured?
  – If not, what percent are hydraulically fractured?