Employment and Population Projections in the Williston Basin

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Dean A. Bangsund
Nancy M. Hodur
Rancy C. Coon
Background

• Starting in 2010, rapid and unprecedented oil and gas development at a pace few people predicted
• In 2011, we were asked to provide some population projections as part of a strategic planning process
• New environment, new dynamic, standard cohort population models not appropriate
• The census not structured to capture total population
• 2010 Census drastically underestimated total people in western ND
  • Large transient workforce not included
  • Rapid in migration
• Need for communities to understand oil development
• As a result led to development of new models linking employment to population
Developed a model that uses projected oil and gas industry employment to model housing needs and population potential.

- Model **Low**, **medium**, and **high** development scenarios based on:
  - **Rate** of oil field development (pace at which the industry will develop the oil fields)
    - Rig counts over time
  - **Size** of oil field development (how big will the oil fields become when well drilling is largely completed)
    - Number of wells

- Primary assumptions based on economics, geology, and regulatory elements
  - **Low** - future conditions less favorable than current conditions
  - **Medium** - future factors similar to current conditions
  - **High** - future factors are improved from current conditions
Model has multiple dynamic elements

Annual Changes over 2014-39

- **Drilling efficiency** in ND – 12.4/wells/rig/yr in 2014 to 13 by 2016 to 14.1 in 2022
- **Employment /drilling rig** - 110 FTE/rig in 2014 to 100 by 2020 down to 93 by 2026
- **Fracking Labor** – plug and perf and ball and sleeve – also reducing labor requirements per well fracked over time
- **Oil field service**
  - Model estimates service requirements based on well age
  - Dynamic response in model, higher requirements in early years reduced requirements in later years
- **Oil Well Transportation (crude oil production)**
  - Transportation requirements adjusted to account for time till completion of gathering systems
  - 75 percent reduction in oil well trucking labor requirements over 14 years
- **Secondary employment** – added lagged response function to the model
- **Base Employment** – constrained in Williston & Dickinson regions to show some crowding out effect
What has transpired since 2010?

• The understanding of the geology, technology and economics continues to evolve.

• 2010: 25,000-28,000 wells
• 2011: 30,000-35,000 wells
• 2012: 40,000-45,000 wells
• 2014: 55,000-60,000 wells

1Housing Needs Assessment (Ondracek, Witwer, & Bertsch 2010)
2Dickenson Comprehensive Plan (Bangsund et al. 2012)ND,
3Transmission Authority Electric Load Growth(KLJ/NDSU/UND),
   ND Pipeline Authority (Bentek Energy)
   ND Department of Mineral Resources
4Unpublished updates, ND Legislative Mgmt. (KLJ/NDSU/UND)
What’s changed?

• Reserve estimates have increases

• Well count projection have been revised upward

• Well spacing within drilling units and pay zones is changing.......well spacing closer together

• Improved fracking technologies

• Improved drilling efficiencies
Pace of Oil Field Development

North Dakota Drilling Rigs

- Low
- Medium
- High
- Actual
Size of Oil Field Development

North Dakota Producing Wells

- Low
- Medium
- High
- Actual
Petroleum Sector Employment
Long-term Change

ND Petroleum Sector
Total Direct Employment
Dickinson, Minot, and Williston Regions
Petroleum Sector Employment by Type of Employment
North Dakota
Consensus Scenario
2012
Petroleum Sector Employment—Revised 2014

ND Petroleum Sector Employment
Dickinson, Minot, & Williston Regions
Medium Scenario

- Drilling & Fracing
- Oil Field Service
- Gathering
- Total
Two types of petroleum sector employment

• Permanent Workforce
  • Long-term jobs
  • Normal residents of North Dakota (census population)
  • Activities related to oil field services, maintenance and production

• Temporary Workforce
  • Non-resident workers, shift workers, short-term employment (relative to oil field life cycle)
    • Drilling
    • Fracing
    • Construction
    • Gathering systems, pipelines
Petroleum Sector Employment
North Dakota
Consensus Scenario
2012
Petroleum Sector Employment Development and Long-term Workforce--2014

ND Direct Employment Petroleum Sector
Medium Scenario

- Temporary, Development Employment
- Long-term, Permanent Employment
Total Employment on Regional Basis

- Direct Petroleum
- Secondary
- Other industries and sectors
Total Employment
Actual 2000-2013
Projected 2014-2039

North Dakota
Economy-wide Total Employment
State Planning Regions 1, 2, & 8
Williston Region
Total Employment

State Planning Region 1
Total Regional Employment

[Graph showing employment trends over time with different scenarios: Low, Medium, High, and Actual.]
Minot Region
Total Employment

State Planning Region 2
Total Regional Employment

- Low
- Medium
- High
- Actual
Dickinson Region
Total Employment

State Planning Region 8
Total Regional Employment

- Low
- Medium
- High
- Actual
Employment Summary

• Petroleum sector employment continues to grow in the near term, will eventually peak, and then contract—timing of which depends upon pace and scale of development

• Overall employment in western ND forecasted to continue to grow in near term—how fast and to what extent still difficult to predict

• All three regions have different employment dynamics

• Best approach is to provide frequent updates
Housing Needs

• Use employment projections to estimate housing need
• Housing need still outstrips supply
• Seen little downward pressure on housing prices despite the addition of new housing units; Williston still has the highest average rents in the county
• Again this is housing need, not housing demand
• Estimates do not differentiate between need for traditional housing (e.g. single family home, apartments) and non-traditional temporary housing (e.g. crew camps, skid shacks, conditional use permits)
• Need for a mix of both permanent and temporary housing will continue into the future
Employment to Housing

• Employment drives demand for housing

• In the near term 1 additional job equals demand for 1 additional housing unit

• Over time that ratio was relaxed to account for housing supply catching up with housing demand over time

• Historic ratio of housing to jobs reflects employment increasing at a rate faster than housing
  • 1.18 units/job in 2000
  • 1.07 units/job in 2005
  • .74 units/job in 2012
## Percent Change in Housing Needs, Total Units, by Region, North Dakota, 2014-2019

<table>
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<tr>
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<th>Williston Region</th>
<th>Minot Region</th>
<th>Dickinson Region</th>
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<tr>
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<tr>
<td>2014-2019</td>
<td>37.0</td>
<td>11.6</td>
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</tbody>
</table>
Housing Demand to Population

• Modeling Region Employment to Housing Demand to Population Potential

• Allocate regional housing demand based on historic regional distribution of housing

• Allocate demand for various types of housing (SFH, apartment, mobile homes, etc.) based on historic rates and emerging trends

• Use historic occupancy rates for various types of housing
• Average annual change of 6.3 percent
• Five year change 35.6 percent
• ~96,000 in 2014 to ~131,000 in 2019
• 2 percent average annual change
• 5 year change of 10.9 percent
• ~126,000 in 2014 to ~140,000 in 2019
6.3 percent average annual change
35.6 percent change from 2014-2019
~60,000 in 2014 to ~77,000 in 2019
Key Assumptions/Interpretation

- Estimates Represent Population Potential!
  - Permanent Population Potential
    - Assuming housing supply equal housing demand
    - Communities meet demand for housing
    - Historic occupancy rates are valid
  - Service Population Potential
    - Model assumes temporary workforce has similar characteristics (occupancy rates/demographics) as permanent workforce
    - Some cases may underestimate occupancy, some cases may overestimate occupancy
    - Model is sensitive to small changes in key variables (e.g. occupancy rates)

- Lack good baseline
  - 2010 Census did not capture service population present in 2010
  - Starting with a low baseline
Ongoing studies

- Workforce Characteristics
- Updates to Williston population projections using a housing model under way. Results available by the end of the year.
- Workforce study will provide valuable insight for further revisions of the employment model.
  - Findings of workforce study hopefully will refine population projections.
  - Provide greater insight into the intentions, perceptions, motivations, characteristics of this new workforce
  - Help communities plan for and deliver needed public and private goods and service
  - Help business and industry recruit and retain qualified and stable workforce
- Constant revisions are critical!
Concluding Thoughts...
Great Opportunities

• Shale oil development in western North Dakota has no precedent
  • Oil and gas industry is still growing and projected to continue to grow
  • Williston, Dickinson and Minot are the 1\textsuperscript{st}, 2\textsuperscript{nd} and 5\textsuperscript{th} fastest growing micropolitan areas in US
• Economic growth is not limited to western North Dakota
  • Experienced growth in all major economic sectors
    • Agriculture, technology, manufacturing
  • Fargo and Bismarck are the 4\textsuperscript{th} and 5\textsuperscript{th} fastest growing metropolitan areas in the U.S.
• Record population in ND and a changing population.....largest portion of 20-24 year olds...9.3 percent
Concluding Thoughts....

Great Challenges

• Housing, housing, housing.....still in short supply, still very expensive
• Temporary housing must continue to be part of the mix
  • Workforce recruitment and retention...an issue statewide, but most acute in western ND
• Population
  • Increased population
  • New population...new residents may have different view of community and culture
• Social Impacts...till struggling to catch up....need to build everything
  • Infrastructure is still strained
  • Schools and child care
  • Parks and Recreation
  • Arts and Entertainment
  • Secondary business development
  • Quality of life and lifestyle amenities
• Economic diversification still important... still heavily weighted toward commodities
  • Energy
  • Agriculture
Contacts

• Dean Bangsund can be reached at d.bangsund@ndsu.edu or 701-231-7471

• Nancy Hodur can be reached at nancy.hodur@ndsu.edu or 701-231-7357

• Randy Coon can be reached at randy.coon@ndsu.edu or 701-231-1018

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