

WHITEPAPER

Beyond Shale and the Coming Labor Shortage



INTRODUCTION

Shale oil and gas production in the United States is at an all-time high. The resulting cheap, abundant energy, combined with increased offshore production costs and tax incentives, is bringing manufacturing jobs back to America.

Shale gas production in particular has a significant ripple effect for the domestic economy. The main byproduct of shale gas extraction, ethane, requires domestic processing to make ethylene, a basic component for manufacturing a vast array of widely used chemicals and plastics.

The reliable availability of low-cost ethane has already enticed major petrochemical manufacturers back to the U.S., with plans to spend billions of dollars re-opening or building new manufacturing facilities in the near future.

Combined with competitive demand for skilled labor from Internet giants such as Google and Facebook, this will mean an increased need for skilled trades, of which electricians are among the hardest to staff. Unskilled general maintenance workers will be forced to step in and bridge the gap, and the resulting inefficiencies may prove costly.

Companies that plan ahead to manage the coming skill shortage with troubleshooting training will reduce expensive downtime and take advantage of the manufacturing wave most effectively.

US Oil Production is Soaring

There's no doubt about it: oil is gushing in the U.S. Between 2008 and 2013, crude oil production in the U.S. increased by 47.5%, far ahead of nearest frontrunners Iraq (29.4%) and Canada (23.1%). This rise stands in stark contrast with other nations whose production has actually declined, among them Venezuela (-18.6%), Iran (-19.1%), the UK (-44.3%), and Libya (-45.7%).¹

In the last two years, total U.S. production climbed even more steeply, from just over 6.5 million to more than 9 million barrels per day.¹

Shale oil production in the lower 48 states is responsible for much of that increase. U.S. shale super fields such as Texas's Permian and Eagle Ford and North Dakota's Bakken are producing well over a million barrels of oil per day each, in some cases nearly 2 million.¹

According to BP's Statistical Review of World Energy 2015, America is now the world's leading oil producer, having overtaken Saudi Arabia last year.²

Shale Gas is Booming

Along with the boom in oil has come a significant increase in shale gas production. Between 2007 and 2014, shale gas production grew an astonishing 51% per year. In that same time, says the U.S. Energy Information Administration, proven reserves have increased by 500%.³

The shale boom has helped make the U.S. the world's largest producer of natural gas, a position it took in 2013, producing an all-time high of 328 billion cubic feet per day, an increase of 20% in five years.⁴

In fact, the United States is fast approaching energy independence—less than 30% (27.4%) of the crude and petroleum products the U.S. consumes is imported.¹

Lower Energy Prices, Increased Offshore Costs, and Economic Incentives are bringing Manufacturing Jobs Home

Lower energy prices resulting from the boom and other global economic realities are having a noteworthy effect on the U.S. economy, creating new manufacturing jobs and driving previously "offshored" jobs back to America.

Three main factors are making manufacturing in the U.S. a much more attractive prospect than it was a decade ago:

- 1. Low energy prices:** Inexpensive, abundant energy is lowering the cost of manufacturing in the U.S. relative to the rest of the world, especially in energy-intensive industries. For example, by 2013, natural gas was trading at \$3.25 per thousand cubic feet in the U.S., about one third of the \$10-to-\$11 rate in Europe and less than one-fifth of Asia's \$15 rate.⁵ With recent geopolitical events that may allow Iran to flood the market with cheap oil, energy prices are likely to dip further. And while it is possible that growth could slow if prices fall too much, analysts maintain that even if prices remain at today's low levels, the major shale fields will still be profitable and production will continue.³
- 2. Increased offshore costs:** Wages have been rising steadily in China at roughly 15% per year for the last decade, while U.S. manufacturing salaries have risen only 2.3% in that same time, helping to level the playing field. Quality concerns and the high cost of transportation are also making China a less appealing prospect than it was ten years ago.⁶
- 3. Economic and Tax Incentives:** The Obama administration proposed a \$2 billion-a-year tax credit in 2015, ended tax deductions for shipping jobs offshore in the 2014 budget proposal, and extended the Work Opportunity Tax Credit to the end of 2014, all to encourage employers to bring jobs back to the U.S. Considering that reshoring is a popular issue for both political parties, the trend of government incentives is likely to continue.^{7,8,9}

In response to these favorable conditions, over 200 (mostly American) companies that had moved manufacturing elsewhere have since returned production to the U.S. in the last five years.⁷ Dow Chemical, General Electric, Ford and Caterpillar are among the giants who have recently announced the building of new plants or re-opening of facilities that had been shut down, to the tune of hundreds of millions of dollars' worth of investment. And, after closing down its last U.S. plant over ten years ago, Apple this year announced the opening of a new \$2B data center in Arizona, employing 150 full-time spaces at Apple and creating 300 to 500 construction jobs.^{10,11}

The same circumstances are also making it more attractive for foreign countries to set up in the U.S.; most European and Asian auto manufacturers, for example, now have plants in the U.S.⁷

All of this means jobs are coming to America. In fact, a 2011 study by PricewaterhouseCoopers (PWC) predicted the creation of one million manufacturing jobs in the U.S. by 2025.¹²

Much of the Growth is Coming from Oil, Gas, and Related Industries

Onshoring and reshoring is just part of the new jobs story. The booming energy sector is itself creating jobs in the U.S.

Between 2007 and 2012, over 135,000 well-paying jobs were added in the energy sector. But in addition to that, private capital investment of \$1.4 trillion in related industries—attributed to the shale boom—such as pipelines, rail networks, and drilling and gathering infrastructure could generate as many as 1.6 million jobs, according to McKinsey & Co.³

Byproducts of Shale Gas Production Driving new Manufacturing in the U.S.

In their 2011 study, PWC stated explicitly that in addition to low energy prices, the million jobs would come from demand created by the shale gas industry.¹²

The difference between American shale oil and gas production is that shale gas production creates some very valuable byproducts that have to be dealt with in the U.S. While oil goes through various levels of production, it may be exported for further refinement and processing.

On the other hand, ethane, a desirable shale gas byproduct, requires boots on the ground to process because the U.S. currently lacks the infrastructure to export it. The resulting spin-off industries produce a ripple effect in the domestic economy.

In a process known as steam cracking, ethane is converted to ethylene, a colourless, flammable gas used widely in the petrochemical industry.

Ethylene is a basic component for manufacturing a variety of plastics and chemicals. It is most commonly used in the production of polyethylene, the world's most ubiquitous plastic (think packaging, grocery bags, trash liners, water bottles, and food storage containers). Ethylene is also oxidized to produce ethylene oxide, which is in turn processed into surfactants and detergents. It's alkylated with benzene to produce styrene for packaging and insulation, and rubber for tires and footwear.

Steam cracking is an energy-intensive process, now made more viable by the plentiful supply of ethane combined with lower energy prices.

All of these developments have enticed a significant number of petrochemical companies to open or re-open manufacturing facilities in the U.S. In 2011, seventeen chemical, metal, and industrial companies reported in SEC filings that demand for their products was being driven by shale gas development, compared with zero companies in 2008.¹² Dow Chemical, Formosa Plastics, Bayer Corp., Nucor and other large players in the petrochemical sector have all announced immediate plans to spend over \$100 billion expanding their manufacturing capacity in the U.S.^{3,12}

In fact, the American Chemistry Council has called the shale gas boom “one of the most exciting domestic energy developments of the past 50 years...creating a competitive advantage for U.S. manufacturers, leading to greater investment, industry growth, and jobs.”¹³

Rising Demand for Skilled Labor

Soaring domestic energy production, in particular shale gas production, will amplify the demand for skilled labor in the U.S., including the need for construction workers to build factories, for line workers, and for factory maintenance staff.

The cost of maintaining lines and factories, especially in large-scale, 24/7 environments, will become increasingly challenging to manage.

Complicating matters is the fact that the energy sector will face stiff competition for skilled workers from Internet and social media companies.

Online behemoths Google and Facebook are facing increased demand for data storage. Both are planning to expand data centers throughout the U.S. and have immediate plans to build in Iowa—Facebook in Des Moines, and Google in Council Bluffs. (To put that in perspective, a single Facebook data center started in North Carolina in 2012 put hundreds of electrical workers alone to work for more than two years.)¹⁴

Unfortunately, this rising demand for skilled labor is coming at a time when trades people are aging and apprenticeship training is dropping off.

The situation is especially problematic for electrical and power line workers, trades that are already experiencing major shortages. According to the U.S. Dept. of Labor’s Bureau of Labor Statistics, the demand for electricians is expected to increase 20% (114,700 jobs) between 2012 and 2022, faster than the average of all occupations.¹⁵ Of

the 21 skilled trades professions in the U.S., electrical and electronics engineering techs are the oldest—38% of the jobs are held by people 55 or older.

Seventy-two percent of electrical and electronics repairers are 45 years or older.¹⁶

Canada and the UK are already experiencing similar shortages. In Canada, British Columbia alone is expecting a shortfall of over 7000 electricians in the next decade.¹⁷ The problem is nationwide, though, and has prompted the Canadian government to alter its immigration policies, building a “fast and flexible” system to attract skilled trades people.¹⁸

In the UK, the scarcity of electricians means that workers are having to delay retirement. Even so, there were 20,518 registered electricians in 2005, but only 17,986 in 2012. The most concerning aspect of the shrinking ranks of electrical workers is that between 2006 and 2013, 2639 young electricians left the industry well before retirement age. Shortages in the overall construction trades have prompted calls in Britain for more aggressive promotional campaigns aimed at recruiting high school graduates.¹⁹

Deficits that are severe enough to delay retirement, force changes to immigration policy, and require incentives for youth to join the skilled trades will necessarily cause both wages and staff churn rates to rise dramatically in the immediate future, to the point of disrupting manufacturing.

Skilled Labor Shortages mean more will fall to General Maintenance Workers

As competition increases for skilled electricians, finding trained staff will become expensive, and staff turnover will accelerate as desperate companies poach employees from one another.

As manufacturers find themselves without the necessary skilled workers, more and more responsibility will fall to general maintenance workers, whose lack of specialized

training will result in increased downtime as mistakes start to pile up. The cost of maintaining lines and factories, especially in large-scale, 24/7 environments, will become increasingly challenging to manage.

As individual businesses feel the pressure of these industry trends, they will need to find ways to:

- Bring maintenance apprentices on board and get them ready to maintain the plant/lines as quickly as possible
- Help multi-discipline teams that include generic maintenance workers learn to troubleshoot electrical issues
- Maintain the skill set of existing staff so they can troubleshoot more efficiently and reduce downtime
- Train staff without an electrical background in a safe yet realistic environment

Companies that don't take these steps will pay the price in terms of lost production and sky-high skilled labor costs.

Conclusion

The boom in U.S. shale oil and gas production over the last decade has been little short of astounding, resulting in lower energy prices that are sparking an onshore manufacturing renaissance.

In particular, the abundance of shale gas byproducts such as ethane has revitalized the domestic petrochemical manufacturing sector, causing analysts to predict the creation of more than a million new onshore manufacturing jobs.

The rising demand for skilled labor, however, comes at a time when shortages are already looming, particularly in the electrical trades. The reality for industry is that untrained general maintenance workers will be responsible for maintaining plant lines and keeping equipment running, resulting in costly inefficiencies.

Companies that want to ride out the coming shortages successfully will need to train unskilled staff in a controlled environment to troubleshoot electrical issues.

Table 1. Downtime Costs Estimates

Industry	Average Downtime Costs
Forest Industry	\$7,000/hour
Food Processing	\$30,000/hour
Petroleum/Chemical	\$87,000/hour
Metal Casting	\$100,000/hour
Automotive	\$200,000/hour

Source: Rutgers University Industrial Productivity Training Manual

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