

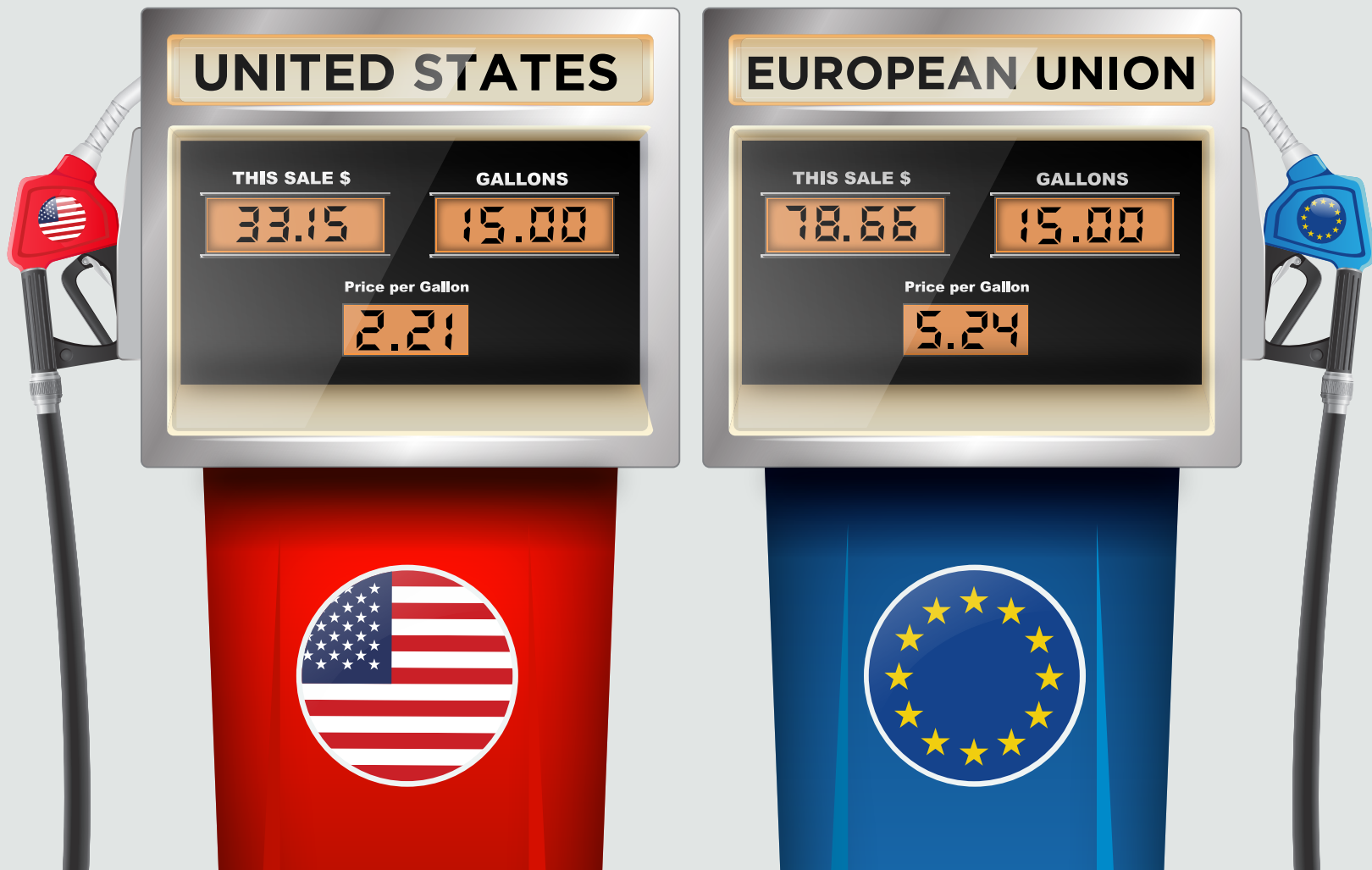
# ENERGY ACCOUNTABILITY SERIES



U.S. CHAMBER OF COMMERCE  
INSTITUTE FOR 21<sup>ST</sup> CENTURY ENERGY

## WHAT IF...

THE UNITED STATES WAS FORCED TO  
PAY EU ENERGY PRICES?



## About the

# ENERGY ACCOUNTABILITY SERIES

This paper marks the third in a series of reports that we will be releasing this fall, each taking a substantive look at what might have happened in the past – or could happen in the future – if certain energy-related ideas and policy prescriptions put forth by prominent politicians and their supporters were actually adopted. We're calling it the Energy Accountability Series.

Certainly, one doesn't need to look far these days to find platforms or outlets that claim to be definitive “fact-checkers” of all manner of utterances candidates make on the campaign trail. On that, the Energy Accountability Series will not seek to reinvent the wheel. What we are much more interested in – and what we think will be much more valuable to voters, as well – is taking a step back to better understand (and quantify where possible) the real-world, economy-wide consequences of living in a world in which candidates' rhetoric on critical energy issues were to become reality.

Too often, there is a temptation to dismiss statements made by candidates as things said “off the cuff,” or in the “heat of the moment,” or offered up merely to “appeal to their base.” This is incredibly cynical, and it needs to change. A candidate's views and the things he or she says and does to win the support of interest groups have a real impact on how policy is shaped, and ultimately implemented.

That is especially true on energy issues today, as groups continue to advance a “Keep It In the Ground” agenda that, if adopted, would force our country to surrender the enormous domestic benefits and clear, global competitive advantages that increased energy development here at home have made possible. Accordingly, candidates and public opinion leaders should be taken at their word, and this series will evaluate what those words would mean for America.

The Energy Accountability Series will ask the tough questions and provide quantitative, clear-eyed answers on the full impacts and implications of these policies, and it will do so irrespective of which candidates, groups or political parties happen to support or oppose them. Our hope is that these reports help promote and inform a fact-based debate of the critical energy issues facing our country. Armed with this information, voters will have the opportunity this fall to make the right choices for themselves and their families.



### OUR MISSION

The mission of the U.S. Chamber of Commerce's Institute for 21st Century Energy is to unify policymakers, regulators, business leaders, and the American public behind a common sense energy strategy to help keep America secure, prosperous, and clean. Through policy development, education, and advocacy, the Institute is building support for meaningful action at the local, state, national, and international levels.



The U.S. Chamber of Commerce is the world's largest business federation representing the interests of more than 3 million businesses of all sizes, sectors, and regions, as well as state and local chambers and industry associations.

# What if the U.S. was Forced to Pay EU Prices for Its Energy?

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With the presidential election just around the corner, voters are trying to better understand the practical implications of the various policy ideas and proposals being put forth. Over the course of the campaign, some interest groups have sought to persuade candidates to support implementing European-style energy policies in the United States. And, at least on some level, it appears that effort has been successful, with a number of candidates today making explicit statements in support of the kind of government controls over energy production and consumption that exist today in the European Union (EU).

For example, U.S. Sen. Bernie Sanders structured his entire energy and environmental policy platform around the adoption of a carbon dioxide reduction plan taken directly from the EU, promising a 40 percent cut in emissions below 1990 levels by 2030. Secretary Hillary Clinton, the Democratic nominee, has vowed to “stop fossil fuels” from being produced on federal lands, and her party’s platform supports a federal renewable electricity mandate of 50 percent by 2027. This goes well beyond anything proposed by the current administration, and even exceeds the EU’s renewable energy target of 27 percent by 2030.

The trend toward European-style policies across a range of different issues (especially energy) was best summarized by Sanders during a debate earlier this year in Las Vegas. “I think,” he said, that “we should look to countries like Denmark, like Sweden, and Norway and learn from what they have accomplished.”

Later, at Sanders’s insistence, environmental activist Bill McKibben – a staunch opponent of fossil fuels – was appointed to the platform committee of the Democratic National Convention. Among other things, McKibben has called on the federal government to “raise the price of fossil fuels” to make the U.S. “look more like Denmark” and praised Germany for implementing a solar energy policy that “has nothing to do with technology or location – it’s all political will.”

With high taxes, restrictive environmental policies, and a heavy reliance on imports, EU businesses and residents pay more than U.S. consumers for electricity, natural gas, motor fuel, and just about every other form of consumable energy. Energy prices play a large part in the performance and competitiveness of the overall economy. High energy prices have a negative impact on the economy – from lower gross domestic product (GDP) growth to fewer jobs and decreased household income.

One European business leader summed up Europe's dire energy situation this way: "I can see green taxes, I can see no shale gas, I can see closure of nuclear, I can see manufacturing being driven away. I can see the competition authorities in Brussels blissfully unaware of the tsunami of imported product heading this way and standing blindly in the way of sensible restructuring . . . It's not looking good for Europe, we are rabbits caught in the headlights, and we have got our trousers down."

The goal of this study, and others to follow it, is to help public audiences better understand and visualize how our country, our economy

and their own individual households might be impacted under a scenario in which candidates' statements and positions as they relate to this issue were converted into policy and implemented on a national basis.

Below are just a few examples of the political rhetoric we continue to see and hear from those who seek to make energy harder to find and more expensive to consume – just like it is in Europe:

“ I think we should look to countries like Denmark, like Sweden and Norway, and learn from what they have accomplished.”

U.S. Sen. Bernie Sanders (D-Vt); Oct. 13, 2015

“Somehow we have to figure out how to boost the price of gasoline to the levels in Europe.”

Steven Chu, Former U.S. Energy Secretary, Dec. 12, 2008

“The easiest thing to do is raise the price of fossil fuels. If that had been done decades ago in the U.S., it would look more like Denmark ...”

Bill McKibben, founder of 350.org & DNC platform committee member; Feb. 15, 2016

“If the tax on gasoline were higher, people would alter their behavior to drive less ... [A] tax exceeding \$2 a gallon makes sense.”

Gregory Mankiw, former chairman, Council of Economic Advisers, Jan. 21, 2012

“The \$10 price per barrel is still just a fraction of the cost carbon imposes on our country, but it's a start.”

350.org, Feb. 4, 2016

“The Clean Power Plan is likely to transform the US power industry just as [renewable energy] targets have radically changed the European energy landscape.”

Gerard Reid, Adjunct Prof. of Business, Imperial College London, April 8, 2015

“And think of what's happening in countries like Spain [and] Germany ... where they're making real investments in renewable energy. They're surging ahead of us ... There is no reason we can't do the same thing right here in America.”

President-elect Barack Obama, Jan. 19, 2009



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# EXECUTIVE SUMMARY

Over the past several years, some interest groups have argued in favor of implementing European-style energy policies in the United States—a notion that dates back to the beginning of the Obama administration. Over time, these efforts have led to leading political candidates today making explicit statements in support of the kind of government controls over energy production and consumption that exist today in the European Union (EU).<sup>1</sup>

As a result of the policies imposed by European governments, residents of EU member countries pay significantly higher prices than U.S. consumers for every type of energy they consume. In recognition of this reality, and set against the backdrop of a political season in which candidates have looked to the EU for energy policy inspiration, the question we seek to answer in this report is: What would happen to U.S. households, businesses and the broader economy if Europe's energy policies and prices were imposed here?

There are large differences between the EU and the United States in the way energy is accessed, delivered, transported, taxed, and regulated. The Energy Institute's analysis identifies four key factors, detailed in the report, that conspire to make energy more costly to consume in Europe and much harder to produce relative to the United States:

- Wholesale restrictions in place in EU countries that inhibit access to low-cost, existing electricity supply and potentially abundant upstream oil and natural gas supplies;
- More generous subsidies provided by EU members for otherwise uneconomic alternative technologies;

- EU policies in place that impose a tax or fee on carbon emissions; and
- Much higher taxes on energy consumption in the EU

Taken together, these four factors have held the European economy back and given the United States (and other low-cost energy countries) a major advantage in the global marketplace. In fact, the Energy Institute's analysis found European electricity, natural gas, and motor fuel, energy prices over the past several years have ranged from between 1.6 to 2.4 times greater than U.S. prices per unit of energy consumed.

The IMPLAN model was used to help determine how these policy differences might affect key performance components of the U.S. economy if they were implemented here.

## KEY FINDINGS

European energy policies and prices would impose a **\$676 billion** drag on the U.S. residential sector and a **\$31 billion** hit to the industrial sector on an annual basis, based on 2014 data.

The average American household would be forced to pay **\$4,800** more per year (or **\$400 per month**) for their energy than they do today

The increase in residential energy prices would have the effect of eliminating the equivalent of **7.7 million** jobs in the United States, owing to depressed demand for labor. Separately, another **273,000** jobs would be lost due to the increase in industrial energy prices; and

Lost labor income tied to the increase in residential energy prices would total **\$364 billion**, in addition to a **\$17 billion** loss on the industrial side – again, all on annual basis.

## STATE-LEVEL IMPACTS

In addition to modeling the aggregate impacts of these European policies and prices on the U.S. economy, the Energy Institute selected a number of states with significant industrial and manufacturing activity to illustrate how energy costs comparable to those in the EU might look and feel on a more local and regional level. The six states we modeled that fit this description are: Colorado, Illinois, Indiana, Michigan, Ohio and Wisconsin. Additionally, we conducted impact-modeling on a seventh state, Florida, to evaluate how energy cost-increases could affect that state's large fixed-income population.

Using IMPLAN's state-level macroeconomic mode to estimate the impacts of a residential price increase to the EU level, we estimate that each of these states would lose billions of dollars in state GDP and labor income, and hemorrhage tens of thousands of jobs. These state-level impacts are summarized in Table 1.

In addition to the residential sector impacts described above, the Energy Institute examined the potential "economic value at risk" for the top 25 energy-intensive industries in these states. Here, we define economic value at risk as the total economic contribution that an industry provides, inclusive of multiplier (i.e., ripple) effects.

Table 2 depicts the economic value at risk more broadly if the top 25 energy-intensive industries were to disappear or be significantly adversely impacted in the states we examined.

As this analysis shows, Europe provides a cautionary tale. Regulatory structures -- including the Emissions Trading System, taxes, user fees, large subsidies, and mandates -- all conspire to make Europe's energy prices among the highest in the world. Exorbitant energy prices are turning Europe's energy-intensive industries into endangered species, and they would do the same thing here if given the chance.

**Table 1: State Level Impact from Residential & Industrial Energy Price Increase (2014)**

Economic Impact	Colorado	Florida	Illinois	Indiana	Michigan	Ohio	Wisconsin
Lost State GDP (billions)	\$6.8	\$28.5	\$17.4	\$7.8	\$11.9	\$14.8	\$6.3
Lost Labor Income (billions)	\$3.9	\$15.9	\$9.9	\$4.3	\$6.8	\$8.2	\$3.5
Lost Annual Employment (FTE – 1,000s)	84.2	377.4	201.2	104.1	159.6	187.2	81.5
Annual Energy Cost Increase (per household)	\$4,730	\$4,980	\$5,230	\$5,450	\$5,310	\$5,000	\$4,720

**Table 2: State-level Economic Value at Risk of the Top 25 Energy-Intensive Sectors (2014)**

Economic Impact	Colorado	Florida	Illinois	Indiana	Michigan	Ohio	Wisconsin
State GDP (billions)	\$11.7	\$31.7	\$48.9	\$60.3	\$52.2	\$57.2	\$40.6
Labor Income (billions)	\$6.8	\$18.2	\$30.6	\$26.2	\$31.5	\$29.9	\$25.1
Annual Employment (FTE – 1,000s)	115.7	338.8	492.9	427.2	521.0	512.8	447.8

## CITATIONS

- 1 For purposes of this report, our analysis is focused on the aggregate of the 28 countries included in the EU. For a list of all 28 countries, see: <https://www.gov.uk/eu-eea>

# CHAPTER 1

## EU POLICY REVIEW

Electricity, natural gas, and motor fuel prices are in each case higher – and, in some cases, significantly higher – in EU countries than they are in the United States. Upon closer review, there are four main drivers that largely explain this phenomenon:

### 1. Wholesale restrictions in the EU on access to low-cost, existing electricity supply and potentially abundant upstream oil and natural gas supplies

A number of European nations have imposed country-wide regulations whose explicit intent is to restrict access to, and consumption of, otherwise lower-cost energy supplies, driving up prices currently being paid by consumers.

Germany, for example, announced plans in 2011 to close all of its nuclear generation capacity by 2022. Replacing this generation with renewable – or even hydrocarbon-derived – energy will have the effect of driving up the delivered price of electricity to end-consumers.

Additionally, the EU's collective policy position of shunning development of much of its natural gas and crude supplies has resulted in a significant and arguably unhealthy reliance on non-EU

imports (Figure 1). The continent is dependent on others for 70 percent of its natural gas and 88 percent of its crude oil (as compared with four percent and 27 percent in the U.S., respectively). Not only does this have obvious price implications, it also has a deleterious impact on Europe's security and geopolitical standing.

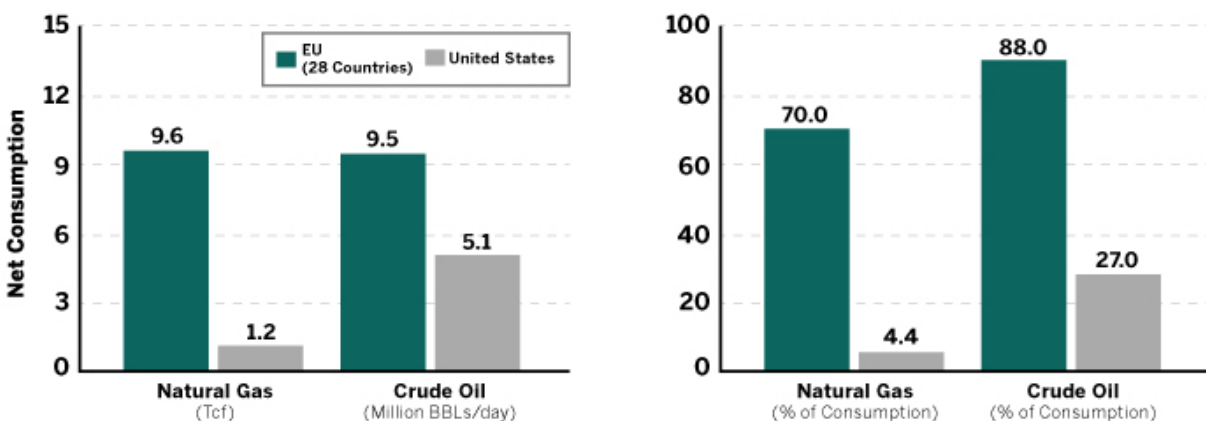
### 2. More generous energy subsidies

The EU's environmental and energy policies have been highly favorable toward alternative sources, such as wind and solar. In fact, from 2005 to 2015, the EU invested over \$750 billion in renewable energy, while the U.S. spent \$330 billion.<sup>1</sup>

As an example of this massive build-out of renewables, Germany – a country with roughly the same solar potential as Alaska<sup>2</sup> – has become one of the leading solar photovoltaic markets in the world. In 2015 alone, Germany's renewable energy portfolio provided the country with a third of its energy.<sup>3</sup>

However, this technology has not come cheaply (or with full reliability). The subsidies provided by the government to fuel the expansion of renewable energy have been paid for by consumers, mostly in the form of a separate

**Figure 1: Natural Gas and Oil Total Net Imports and as a Percent of Consumption 2014**



Source: BP Statistical Review of World Energy June 2015 and Eurostat

and specific renewables surcharge. In 2014, this surcharge alone accounted for approximately 21 percent of the average customer's bill.<sup>4</sup> Moreover, dealing with large amounts of intermittent power can lead to higher prices by increasing grid balancing costs.

### 3. Policies that impose a tax or fee on carbon emissions

Restrictive regulations, such as the EU ETS,<sup>5</sup> taxes on carbon emissions, and the Large Combustion Plant Directive,<sup>6</sup> have had an obvious and direct impact on energy prices. As more restrictive emissions targets are imposed over time, more fossil-fired generation is being shut down. One analyst recently noted that “fossil generators are facing an increasingly difficult operating environment, with a poor demand outlook, aging fleet, subsidies for renewables and policies to reduce emissions all having their hand in closures.”<sup>7</sup>

The EU ETS – which created Europe's carbon trading market – represents another policy mechanism that has added to the cost of energy. The ETS is the world's largest carbon cap-and-trade market and has existed since 2005. It covers GHG emissions from power and heat generation, energy-intensive industrial and manufacturing,<sup>8</sup> and civil aviation sectors in 31 countries.<sup>9,10</sup> In 2014, CO<sub>2</sub> prices averaged €5.88 (\$6.47) per metric ton,<sup>11</sup> which amounts to approximately €6.92 (\$7.62) per megawatt hour of electricity produced<sup>12</sup> or a 17 percent premium over the average, wholesale cost of electricity produced in Europe.<sup>13</sup>

The EU ETS is a major element in the bloc's program to cut GHG emissions 40 percent below 1990 levels by 2030. It penalizes higher carbon-emitting technologies with a carbon price, thereby also providing a subsidy to renewables. While many legislative attempts have been made in the U.S. to implement a carbon cap-and-trade at the national level, they have failed and only a handful of mostly coastal states have moved ahead with their own versions of cap-and-trade.<sup>14</sup>

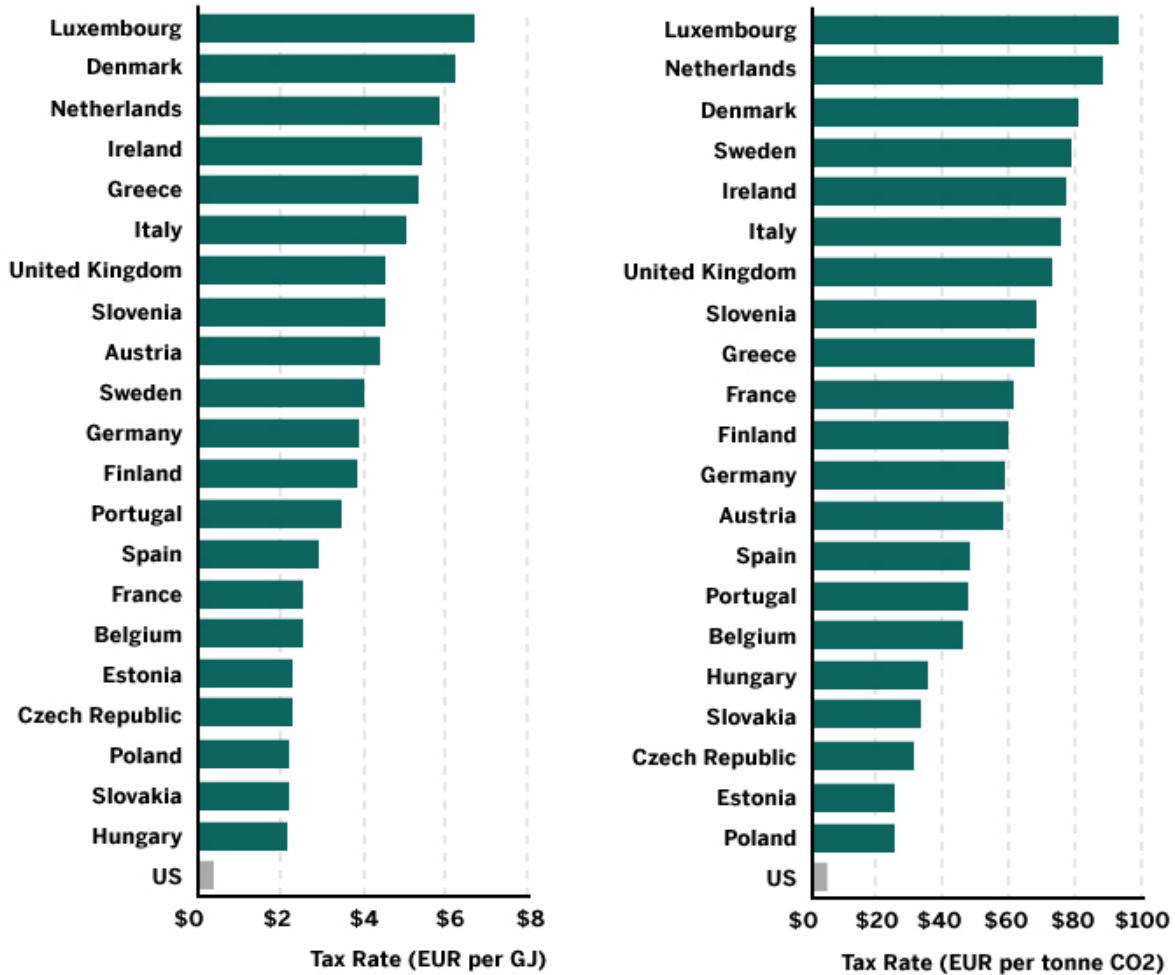
### 4. Higher taxes on energy consumption

Higher taxes and fees on energy consumption is one of the main drivers of higher energy prices in the EU. In fact, according to a 2015 report from the OECD on taxing energy use, the “highest overall tax rates tend to be seen in countries which are members of the European Union.”<sup>15</sup> The report goes on to note that the “energy tax policy is significantly shaped by the 2003 EU Energy Taxation Directive, which sets minimum tax rates for a wide range of energy commodities.”<sup>16</sup>

While the goal of this policy is to “reduce distortions caused by divergent national tax rates, remove competitive distortions between mineral oils and other (unlegislated) energy products, and create incentives for energy-efficiency and emission reductions,”<sup>17</sup> it creates higher prices for consumers and businesses.

For example, Figure 2 illustrates the effective energy<sup>18</sup> and carbon-dioxide tax rates across various countries. These rates are substantially higher in the EU – approximately 20 times higher – than in the United States.

Figure 2: Economy-wide Average Effective Tax Rates on Energy (left) and on CO<sub>2</sub> from Energy (right)



Source: OECD (2015). Tax rates are as of April 1, 2012. U.S. figures do not include state taxes

In 2014, the EIA conducted an analysis that compared residential electricity prices in the EU with those in the United States. The results align with the findings in the charts above. That is, taxes are much higher in the EU, which contribute directly to the overall higher cost of energy.

For example, in 2013, EU countries taxed residential electricity rates at an average of 31 percent, with a low of five percent (UK) and a high of 57 percent (Denmark).<sup>19</sup> For motor fuel, at \$3.36 per gallon, gasoline taxes in the EU are almost 7 times higher than the U.S.; at \$2.38 per gallon, diesel taxes are 4 times higher.



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- 4 In 2014, the renewable surcharge was EUR 6.24 cents/kWh, or about USD 8 cents/kWh. To put this into perspective, the U.S. average retail residential electricity rate was 12.5 cents/kWh. Thus, Germany's surcharge represents 2/3rd of the U.S. price.
- 5 The EU ETS is the world's largest cap-and-trade carbon market. The EU ETS requires utilities and industry to hold allowances to cover their pollution. Allowances can be bought and sold on an open market and the allowable pollution targets decrease over time, making compliance more difficult and expensive for traditional fossil-fueled generators. For more info, see: [http://ec.europa.eu/clima/policies/ets/index\\_en.htm](http://ec.europa.eu/clima/policies/ets/index_en.htm)
- 6 The LCPD is a directive that is meant to limit the amount of flue gas emissions specifically for Sulphur dioxide, nitrogen oxides, and dust. For more info, see: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=URISERV:percent3AI28028>
- 7 EU Shuttles Most Coal, Natural Gas Power in Six Years. (2015). Bloomberg.com. Retrieved 3 May 2016, from <http://www.bloomberg.com/news/articles/2015-02-11/eu-shuttles-most-coal-natural-gas-power-in-six-years>
- 8 Energy-intensive industry includes oil refineries, steel works and production of iron, aluminum, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals.
- 9 The 31 countries include all of the EU 28 countries plus Iceland, Liechtenstein and Norway.
- 10 The EU Emissions Trading System (EU ETS) Fact Sheet. [http://ec.europa.eu/clima/publications/docs/fact-sheet\\_ets\\_en.pdf](http://ec.europa.eu/clima/publications/docs/fact-sheet_ets_en.pdf)
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- 12 Based on an average historical emission rate from of 1.18 tonnes per MWh in the EU (excludes non-EU countries included under the EU ETS). \$6.92/MWh = 1.18 tonne of CO<sub>2</sub>/MWh x \$5.88/ tonne of CO<sub>2</sub>.
- 13 Average wholesale electricity prices in the EU were at about €40/MWh. See [https://ec.europa.eu/energy/sites/ener/files/documents/EnergyDailyPricesReport-EUROPA\\_0.pdf](https://ec.europa.eu/energy/sites/ener/files/documents/EnergyDailyPricesReport-EUROPA_0.pdf)
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CHAPTER

2

ENERGY PRICE  
COMPARISON:  
UNITED STATES VS. EU

Energy prices in the EU on a per unit basis have historically been much higher than prices for the same energy products used in the United States. In this section, we show how the price differentials for electricity, natural gas, and motor fuel have stacked up over time.

### DATA SOURCES & ENERGY PRICE DIFFERENTIALS

For U.S. energy data, we rely on EIA for annual estimates of prices.<sup>1</sup> For the EU, we rely on price data from the European Commission's Eurostat<sup>2</sup> and the European Environment Agency (EEA).<sup>3</sup> We also utilize various conversion factors and the U.S. Internal Revenue Service (IRS) for historical exchange rates.<sup>4</sup>

The differences in energy pricing regimes between the United States and EU are apparent both in an industrial context, and a residential one. In 2014, these sectors accounted for approximately 64 percent of total U.S. electricity consumption and 52 percent of total U.S. natural gas consumption. Additionally, the residential sector accounted for 85 percent of the total U.S. petroleum consumption for transportation use in 2014.<sup>5</sup>

Given their consumption levels, the residential and industrial sectors serve as good indicators of how the larger U.S. economy would be impacted if EU-style policies were adopted.

### ELECTRICITY PRICES

Figure 3 illustrates how historical residential electricity prices have compared between the U.S. and EU from 2010 to 2014. Delivered residential electricity prices in the EU during this period averaged near \$240/MWh, **whereas the U.S. averaged nearly \$120/MWh, or less than half of EU prices.**

Additionally, residential electricity price growth over this time period differs significantly, with the EU rising 22 percent (or five percent annually), while prices in the U.S. increased by only eight percent (or two percent annually). A similar story can be seen in the industrial sector.<sup>6</sup>

For delivered residential natural gas prices (Figure 4), the U.S. experienced a slight decline of four percent from 2010 to 2014, driven primarily by the increase in domestic supply of natural gas from shale.<sup>7</sup> The EU, on the other hand, saw an increase in delivered residential natural gas prices of 29 percent.<sup>8</sup>

**Figure 3: U.S. and EU Residential Electricity Price Comparison, 2010-2014, (USD/MWh)**

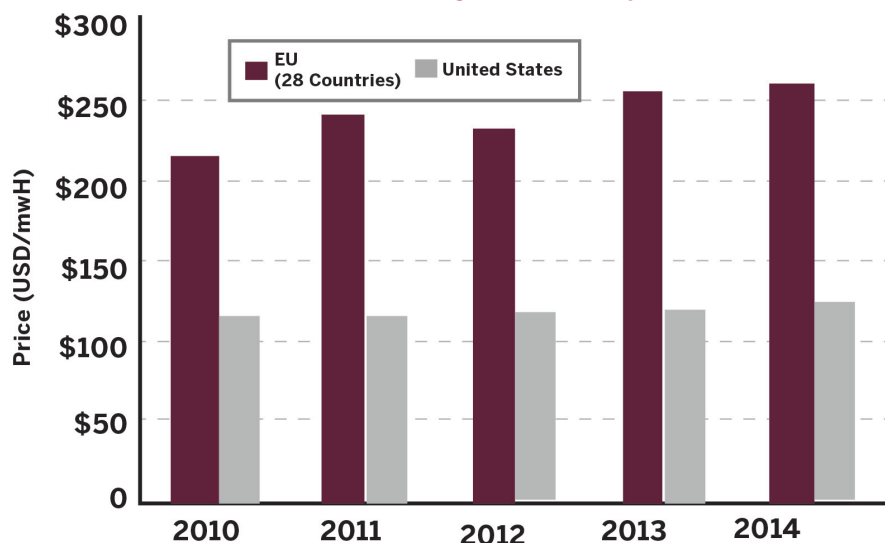


Figure 4: U.S. and EU Residential Natural Gas Price Comparison, 2010-2014, (USD/mcf)

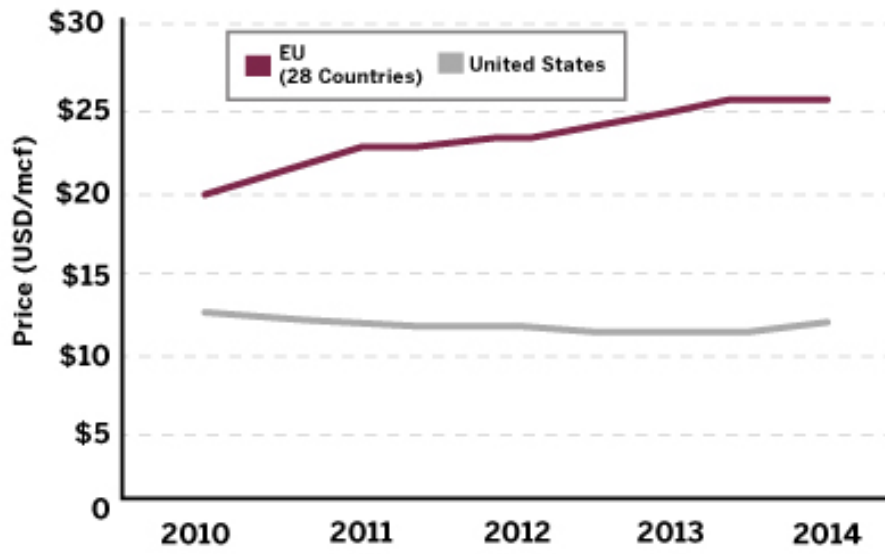
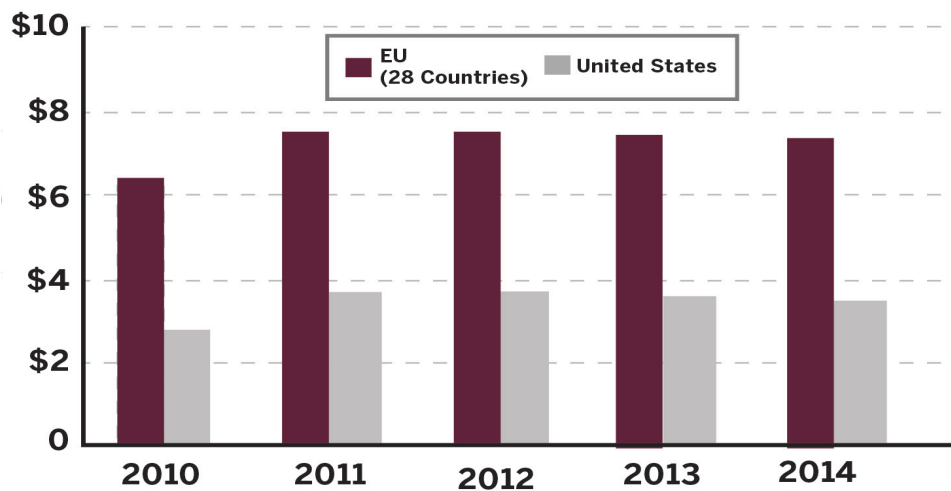


Figure 5: U.S. and EU Gasoline Price Comparison, 2010-2014, (USD/gallon)



For delivered industrial natural gas, prices remained somewhat constant in the U.S. while they increased by over 26 percent in the EU from 2010 to 2014.

A similar picture emerges for gasoline and diesel fuel prices. Motor fuel prices in the EU were 2.1 to 2.3 times higher than U.S. prices for gasoline and 1.8 to 1.9 times higher for diesel fuel from 2010 to 2014. By 2014, U.S. gasoline prices averaged \$3.44/gallon whereas EU prices averaged \$7.42/gallon, as shown in Figure 5. Diesel fuel prices follow a similar pattern as gasoline prices, with

EU prices nearly double those in the United States.<sup>9</sup>

The price differences between the U.S. and the EU are significant across all major fuel types. In general, in 2014 EU residents paid 77 to 127 percent more for energy compared to U.S. residents and EU industrial consumers paid 65 to 143 percent more than U.S. industries.

As highlighted previously, EU energy and environmental policies can explain much of the price differences.

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- 5 See [https://www.eia.gov/totalenergy/data/monthly/pdf/sec3\\_26.pdf](https://www.eia.gov/totalenergy/data/monthly/pdf/sec3_26.pdf).
- 6 EU average price for 2010-2014 in the Industrial sector is equal to \$119/MWh, while U.S. prices averaged approximately \$69/MWh. However, from a price growth perspective, the EU remained relatively flat, whereas the U.S. experienced a 5 percent increase in price (or about 1.2 percent annually).
- 7 U.S. dry natural gas production increased from 21.3 Tcf in 2010 to over 25.7 Tcf in 2014, representing over a 20 percent increase from 2010 volumes.
- 8 Although we do not display it graphically here, we see similar patterns in gasoline and diesel fuel prices.
- 9 For diesel fuel, the U.S. averaged \$3.83/gallon, while the EU was at \$6.77/gallon in 2014.

CHAPTER **3**  
MACROECONOMIC  
REVIEW

Affordable energy prices are a major driver and facilitator of economic growth. Lower energy prices create benefits in the form of lower operating costs for businesses and higher disposable income for consumers, which when combined have the effect of increasing employment and overall economic output.

While many other factors contribute to the overall health, strength, and competitiveness of a given economy, a number of studies have detailed the relationship between access to affordable energy and a growing economy. For example, a recent U.S. Council of Economic Advisers report notes that increasing production of oil and natural gas “has contributed broadly to employment and gross domestic product (GDP) growth during the recovery from the Great Recession.”<sup>1</sup>

In this section, we provide a brief overview of how specific macroeconomic indicators have differed between the U.S. and EU over time.

## GROSS DOMESTIC PRODUCT/ECONOMIC OUTPUT

Europe’s combined gross domestic product (GDP) is roughly similar in size to that of the United States. In 2014, the EU’s GDP was \$18.5 trillion compared to U.S. GDP of \$17.4 trillion.<sup>2</sup> Leading up to the recession, the gap between the EU’s GDP and United States’ GDP was much greater – exceeding \$3.2 trillion in 2007.

This gap has closed significantly in the intervening years, mainly due to much different rates of economic growth. From 2008 to 2014, the U.S. experienced an annual average GDP growth of 2.8 percent compared to -0.5 percent in the EU. Figure 6 shows how GDP has changed over time between the U.S. and EU.

While the U.S. GDP was obviously impacted by the recession as well, it has since recovered. As shown in the figure above, U.S. GDP has been steadily catching up to the EU’s.

On a per capita basis, the U.S. GDP is well ahead

**Figure 6: U.S. and EU GDP, 2008-2014, (USD Trillions Nominal)**

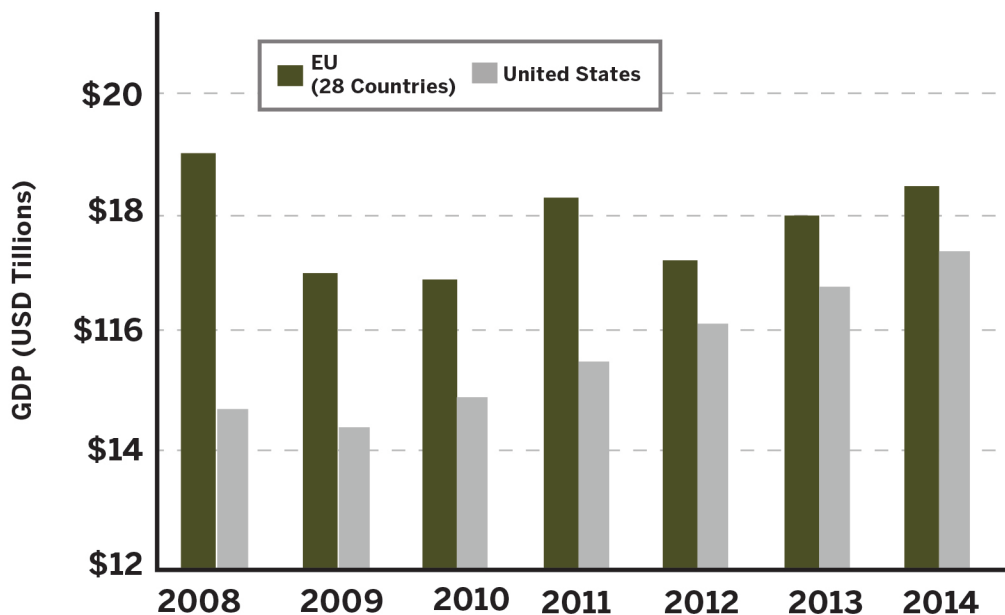
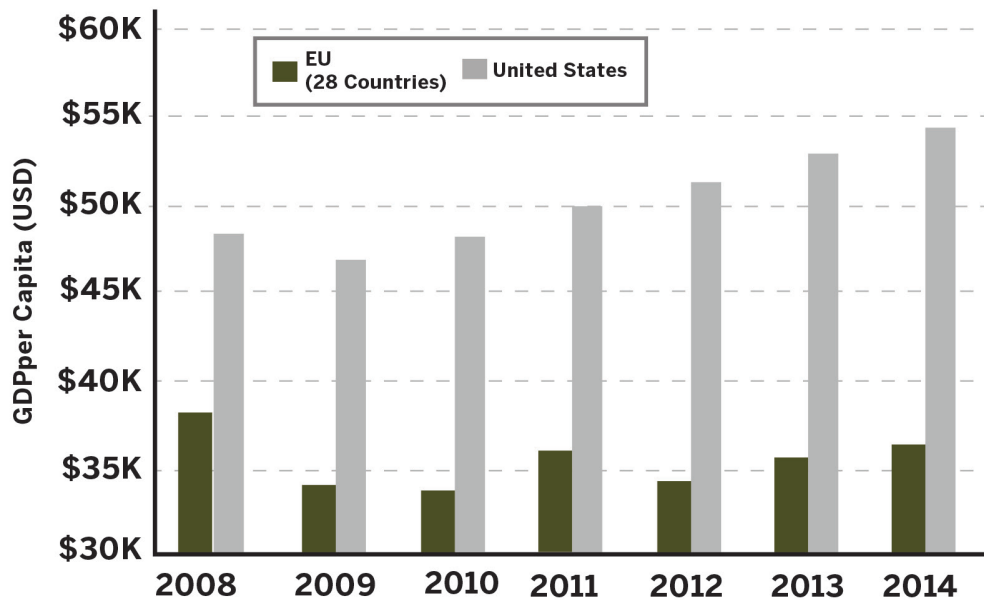




Figure 7: U.S. and EU GDP per Capita, 2008-2014, (USD Nominal)



of the EU. Between 2008 and 2014, U.S. GDP per capita grew 13 percent (from \$48,400 to \$54,600), while EU GDP per capita decreased by 0.4 percent (from \$37,900 to \$36,400). By 2014, the gap in GDP per capita between the U.S. and the EU was just over \$18,000 (Figure 7).

Ultimately, the EU has struggled to return to pre-recession economic output levels on both an absolute GDP basis and a per capita basis, as indicated by the two figures above. Part of this struggle occurred when it fell back into a recession beginning in the third quarter of 2011.

#### EMPLOYMENT AND HOUSEHOLD INCOME

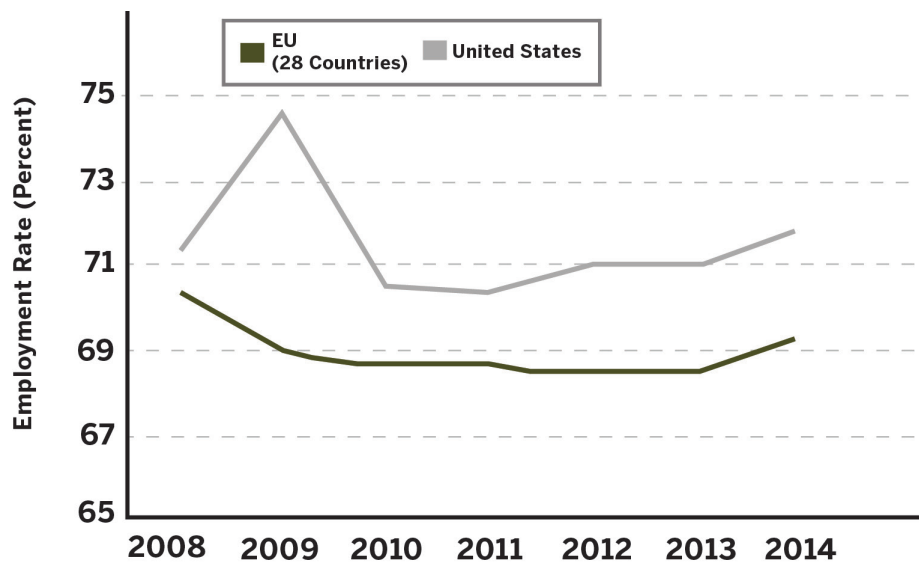
Employment and household income are two other measures to gauge the health of a given economy. These additional macroeconomic indicators paint a broader picture of an economy's overall health. For example, higher levels of employment tend to provide more income to consumers and directly affect a nation's level of productivity. It is important, then, to understand how higher energy prices might affect these indicators.

As it relates to employment, the U.S. has seen higher employment levels than the EU since the recession. From 2008 to 2014, the job market in the U.S. grew 0.7 percent annually<sup>3</sup> (from 128.8 million to 134.0 million employees) compared to -0.3 percent annually<sup>4</sup> (from 213.4 million to 209.5 million employees) in the EU.

The EU experienced a steady decline from 2008 until 2013 and then an uptick in 2014 as shown in Figure 8. Countries like Spain and Greece have weighed heavily on the EU's employment numbers as they have exceptionally high unemployment rates (26.7 percent and 27.8 percent, respectively) particularly with youth unemployment (55.5 percent and 57.1 percent, respectively) in 2014.<sup>5</sup>

A major driver of the higher rate of economic growth in the U.S. has been the growth of oil and gas production. This production growth has created economic benefits across the entire oil and gas value chain.

**Figure 8: U.S. and EU Employment Rate, Ages 20-64, 2008-2014 (percent of age group population)**



Various studies have shown the enormous effect the “shale revolution” has had on the U.S. economy. The 2015 Economic Report of the U.S. President estimates that “the oil and natural gas sectors alone contributed more than 0.2 percentage point to real GDP growth between 2012 and 2014, in contrast to a slight negative contribution on average from 1995 to 2005.”<sup>6</sup> Additionally, the “contribution between 2012 and 2014, which does not count all economic spillovers, added substantially to the 2.4 percent average annualized rate of U.S. economic growth over these three years.”<sup>7</sup>

Another report, which focused on 2011, estimated that the total operational and capital investment impact of the oil and natural gas industry to the U.S. economy was \$1.2 trillion (or 8 percent of U.S. GDP in 2011).<sup>8</sup> Additionally, McKinsey Global Institute released a report stating that “shale energy could revitalize the oil and gas industry, have downstream benefits for energy-intensive manufacturing, and send ripple effects across the economy.”<sup>9</sup> The report goes on to estimate that the shale boom “could add 2 to 4 percent (\$380 billion to \$690 billion) to annual

GDP and create up to 1.7 million permanent jobs by 2020.”<sup>10</sup>

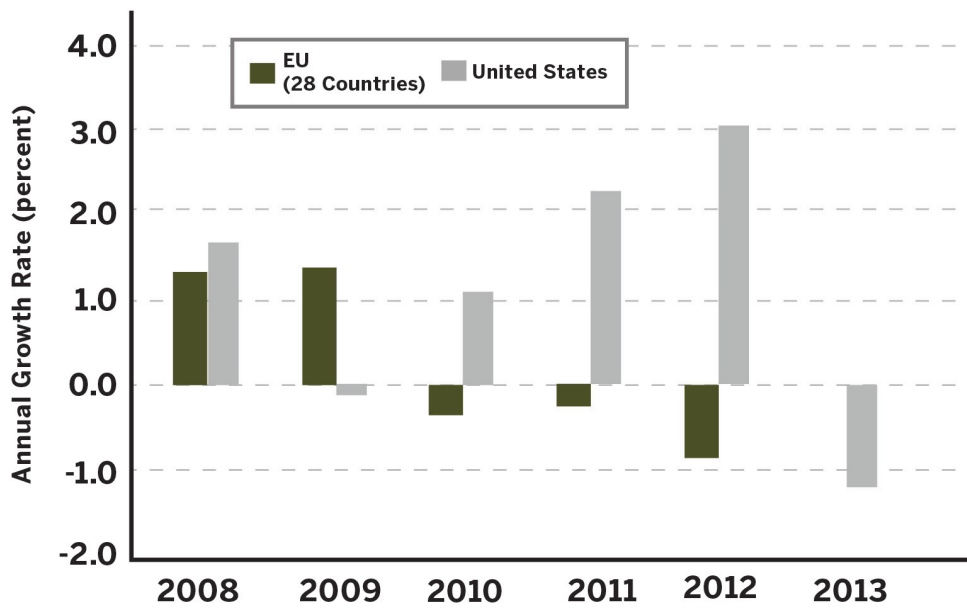
The International Energy Agency (IEA) also chimed in, stating that “the shale gas boom will boost US manufacturing and jobs until at least 2035...reinforcing America’s economic edge over Asia and Europe for the next two decades.”<sup>11</sup> Furthermore, the IEA “warned that Europe would need to embrace tough reforms to avoid falling behind the US over the next 20 years.”<sup>12</sup> In July 2014, the IEA stated that “the U.S. shale-gas boom is placing 30 million jobs at risk in Europe as companies with greater reliance on energy contend with higher fuel prices than their American counterparts.”<sup>13</sup>

In addition to total jobs and the employment, disposable household income rates are helpful indicators of economic performance. Net disposable household income annual growth rates for the U.S. and the EU are shown in Figure 9. The U.S. has had somewhat consistent annual growth in disposable income, averaging 1.1 percent each year, while the EU has averaged just 0.2 percent annual growth.

Lower energy prices have had a clear and positive impact on economic growth in the U.S. The linkage between energy prices and economic output has been studied extensively. One study states that in the case of an oil price shock, the “effects are not trivial” and that “oil shocks have caused and/or contributed to each one of the US and global recessions in the last thirty years.”<sup>14</sup>

Other studies come to similar conclusions – energy prices do play a role in the economic prosperity of a nation.<sup>15</sup> The EU, for its part, has been stuck in a high energy price environment since the recession due to policies and circumstances that are largely self-imposed, which in turn have slowed the pace of its recovery.

**Figure 9: U.S. and EU Net Household Disposable Income Annual Growth, 2008-2013 (percent)**



Source: OECD. Data for U.S. only available through 2013. See: <https://data.oecd.org/hha/household-disposable-income.htm>

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- 2 The World Bank, <http://data.worldbank.org/indicator/NY.GDP.MKTP.CD/countries/EU?display=default>.
- 3 See BLS, <http://www.bls.gov/lau/>. This calculation includes all civilian labor force employment for the 20-64 age group.
- 4 See Eurostat, Employment by sex, age and citizenship data table. <http://ec.europa.eu/eurostat/web/lfs/data/database>.
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# 4

CHAPTER

## SCENARIO ANALYSIS: ENERGY PRICE IMPACT

The previous sections demonstrate how much more expensive energy products have been in EU countries in recent years relative to the United States, with additional discussion of how higher prices may have affected economic growth and contributed to the EU's relatively slower rebound following the global recession. In this section, we seek to quantify the impact of EU-style policies on the U.S. economy – especially insofar as they have the effect of increasing U.S. delivered energy prices to EU levels.

We also take a closer look at how the economies of seven U.S. states – Colorado, Florida, Illinois, Indiana, Michigan, Ohio and Wisconsin – might fare if their businesses and consumers were forced to operate under an EU energy-pricing regime.

### ANALYTICAL METHODOLOGY

The analysis presented here shows the potential impacts in a single year – 2014 – if the U.S. were to be forced to operate under EU-level energy prices.<sup>1</sup> To model the overall macroeconomic impact of these higher prices, we started by calculating the percentage differences between energy prices in the U.S. and EU. For data, we relied on the following:

- EIA for annual estimates of U.S. prices.<sup>2</sup>
- European Commission's Eurostat<sup>3</sup> and the European Environment Agency (EEA) for EU price data.<sup>4</sup>
- US Census Annual Survey of Manufacturers (ASM)<sup>5</sup> and the EIA's Manufacturing Energy Consumption Survey (MECS)<sup>6</sup> for Industrial energy expenditures and fuel consumption shares.
- U.S. IRS for historical exchange rates.<sup>7</sup>
- Bureau of Labor Statistics (BLS) Consumer Expenditure Survey for historical U.S. consumer expenditures.<sup>8</sup>

Table 3 illustrates how retail energy prices differ between the U.S. and EU for the residential and industrial sectors for 2014. Energy prices were nearly double per unit of consumption in the EU across the board. For example, the U.S. average price for retail electricity in 2014 was \$125.20/MWh, whereas the EU's price was \$259.31/MWh, or 207 percent of the U.S. price.

The percent-difference values we calculate in the table above represent the starting point for our total economic impact analysis.

**Table 3: Retail Energy Price Differential Impacts, 2014**

	US Price (USD/unit)	EU Price (USD/unit)	% Difference
<b>Residential</b>			
Electricity (MWh)	\$125.20	\$259.31	107%
Natural Gas (mcf)	\$10.97	\$24.94	127%
Motor Fuels (gallons)			
Gasoline	\$3.44	\$7.42	116%
Diesel	\$3.83	\$6.77	77%
Wtd. Gas & Diesel			107%
<b>Industrial</b>			
Electricity (MWh)	\$71.00	\$116.96	65%
Natural Gas (mcf)	\$5.55	\$13.50	143%

## ECONOMIC IMPACT MODELING & ASSUMPTIONS

To conduct this analysis, the IMPLAN model was used to estimate the overall macroeconomic effects of higher energy prices. IMPLAN is a general input-output modeling software and data system that tracks the movement of money and resources through an economy, looking at linkages between industries along the supply chain to measure the cumulative effect of spending in terms of job creation, income, production, and taxes.

As such, IMPLAN helps us understand and quantify the so-called economic “ripple” (or multiplier) effect that tracks how each dollar of input, or direct spending, cycles through the economy to suppliers and ultimately to households.

To model the overall macroeconomic impact of higher energy prices, we start with the percentage differences calculated in Table 3 above. We assume that the additional energy costs come in the form of lost consumer income for the residential sector<sup>9</sup> and lost margin for the industrial sector.

Additionally, we assume that under the higher-

price scenario, consumption stays constant. Implicitly, we are assuming that Americans would want to maintain the same standard of living (to the extent possible) under higher energy prices. Of course, demand isn’t completely inelastic, but several studies have shown that short-term demand is highly inelastic under price increases.

For example, one study found that “demand is relatively inelastic to price [and that] in the past 20 years, this relationship has not changed significantly.”<sup>10</sup> Another study notes that “electricity price elasticities in general are expected to be fairly inelastic due to limited substitution possibilities for electricity.”<sup>11</sup>

For our residential consumer impact analysis, we rely on the BLS Consumer Expenditure Survey for the annual average consumer expenditures on energy, broken down by income level. Because we assume that consumption at every income level stays constant under a price change, we increase the average energy expenditure for electricity, natural gas, and motor fuel for each income level by the price differentials calculated in Table 3. These calculations are displayed in Table 4.

**Table 4: Average Residential Electricity, Natural Gas, and Motor Fuel Expenditure by Income Level (2014, \$Billions)**

Income Bracket	2014 Actual Expenditure	Increased Price Scenario	Difference
Less than \$10k	\$25.5	\$53.3	-\$27.8
\$10k to \$15k	\$20.1	\$42.1	-\$22.0
\$15k to \$25k	\$48.8	\$102.0	-\$53.3
\$25 to \$35k	\$76.2	\$159.4	\$55.8
\$35k to \$50k	\$73.3	\$153.4	-\$80.1
\$50k to \$75k	\$102.4	\$214.2	\$111.8
\$75k to \$100k	\$71.7	\$150.1	-\$78.4
\$100k to \$150k	\$88.9	\$180.1	\$97.2
\$150k and more	\$76.0	\$159.4	\$83.4
<b>Total</b>	<b>\$582.8</b>	<b>\$1,219.9</b>	<b>\$609.7</b>

**Table 5: Average Industrial Electricity and Natural Gas Expenditure, Top 25 (2014, \$Billions)**

	Industry	NAICS	2014 Energy Spending (Billion \$)	Increased Price Scenario (Billion \$)	Difference
1	Petroleum refineries	32411	\$10.2	\$20.3	\$10.1
2	Other Basic Organic Chemical Manufacturing	32519	6.1	8.9	2.8
3	Iron and steel mills and ferroalloy manufacturing	3311	5.6	8.5	2.9
4	Paper Mills	32212	3.3	5.4	2.1
5	Plastics material and resin manufacturing	325211	3.2	4.5	1.3
6	Paperboard Mills	32213	2.6	4.3	1.7
7	Petrochemical Manufacturing	32511	2.5	4.2	1.6
8	Motor Vehicle Parts Manufacturing	3363	2.1	3.6	1.5
9	Other plastics product manufacturing	32619	1.9	3.2	1.3
10	Semiconductor and related device manufacturing	334413	1.6	2.7	1.1
11	Industrial gas manufacturing	32512	1.5	2.9	1.3
12	Cement manufacturing	32731	1.5	2.0	0.6
13	Printing	32311	1.3	2.3	1.0
14	Alumina refining and primary aluminum production	331313	1.1	1.9	0.8
15	Lime and gypsum product manufacturing	3274	0.9	1.6	0.7
16	Plastics packaging materials and unlaminated film and sheet manufacturing	32611	0.9	1.5	0.6
17	Ferrous metal foundries	33151	0.9	1.4	0.5
18	Paperboard container manufacturing	32221	0.9	1.4	0.6
19	Poultry processing	311615	0.8	1.5	0.6
20	Wet corn milling	311221	0.8	1.3	0.5
21	Sawmills and wood preservation	3211	0.7	1.2	0.4
22	Pharmaceuticals preparation manufacturing	325412	0.7	1.2	0.5
23	Fertilizer manufacturing	32531	0.7	1.4	0.7
24	Fruit and vegetables canning, pickling, and drying	31142	0.7	1.3	0.7
25	Other general purpose machinery manufacturing	3339	0.7	1.1	0.5
	<b>Total</b>		<b>\$53.0</b>	<b>\$89.5</b>	<b>\$36.5</b>



**Overall, residential energy expenditures more than double from \$583 billion to \$1,220 billion under the EU price scenario.**

This \$610 billion increase in costs would directly reduce the amount of money each household has available to spend on goods and services. This indirect impact on the economy is modeled in IMPLAN.

For our industrial impact analysis, we ranked the top 25 industries based on total electricity and fuel consumption using the US Census's Annual Survey of Manufacturers (ASM). We also used EIA's Manufacturing Energy Consumption Survey (MECS) data to calculate the percentage of fuel that was spent on natural gas.

As with our Residential analysis, we assume that energy consumption stays constant while prices change. As Table 5 shows, the total cost impact to these industries is \$36.5 billion.

## RESULTS

We first ran IMPLAN to calculate the macroeconomic impacts of lower residential household incomes caused by higher energy prices. We reduced the household income level for each income bracket as outlined above in Table 4. IMPLAN calculated the indirect and induced economic impacts, which resulted in **\$644 billion in lost GDP opportunities**; more than **\$364 billion in lost labor income**; and nearly **7.4 million jobs** lost as well, as shown in Table 6.

Our modeling indicates that higher energy prices (assuming consumption remains constant) lowers overall economic output, reduces labor income, and creates a significant loss in employment. These impacts are felt across a number of industrial sectors. In Figure 10, we show the top 10 most impacted North American

**Table 6: Aggregate Residential Economic Impacts due to Increased Energy Prices, 2014**

Economic Impact	Aggregate Economic Lost Opportunity
GDP	\$644.3 billion
Labor Income	\$364.1 billion
Annual Employment	7.4 million jobs

Industry Classification System (NAICS) sectors and the lost GDP opportunity each sector would have experienced under the higher energy price scenario in the residential sector.

For example, the Health Care and Social Assistance sector would have lost approximately \$82 billion, while the Real Estate and Rental and Leasing sector would have lost \$62 billion.

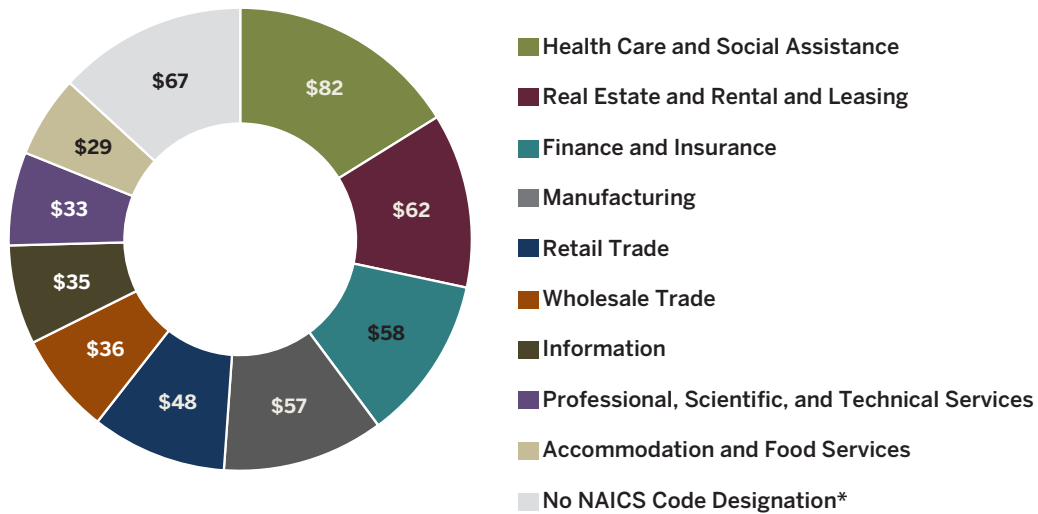
For the industrial sector, we found that the overall impact of higher energy prices equates to \$31.2 billion in lost GDP. This economic hit also equates to over \$16 billion in lost labor income and just over 273,000 jobs, as shown in Table 7.

**Table 7: Aggregate Industrial Economic Impacts due to Increased Energy Prices, 2014**

Economic Impact	Aggregate Economic Lost Opportunity
GDP	\$31.2 billion
Labor Income	\$16.7 billion
Annual Employment	273,100 jobs

We note that these figures are somewhat conservative given that the impact modeled was only on the top 25 industrial sectors. Furthermore, because we assume for the purposes of this study that an increase in price does not retard consumption, we zero-out any induced and indirect losses associated with

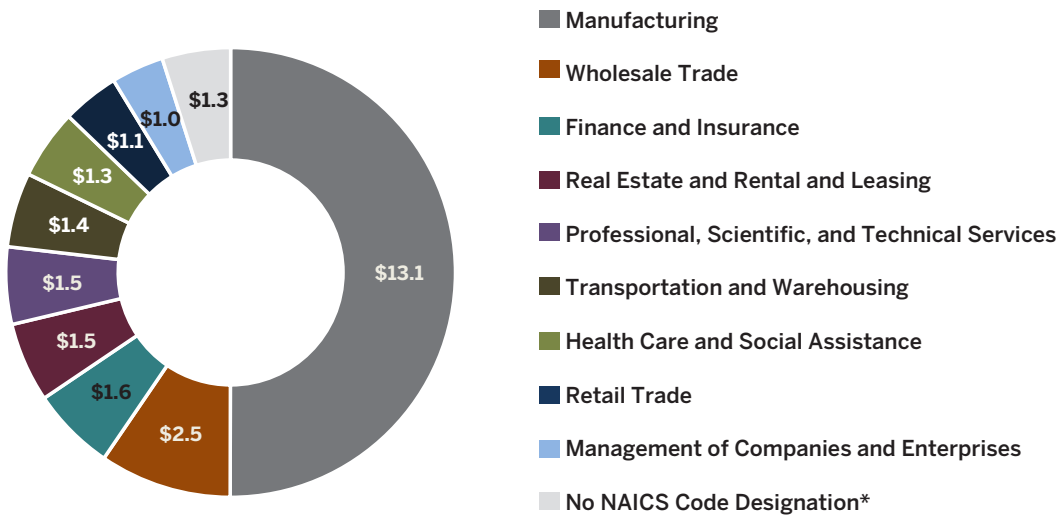
**Figure 10: GDP Impacts of the Top 10 NAICS Industry Sectors from Residential Price Increases, 2014, (\$ Billions)**



All other Sectors Total GDP Impact: \$139 billion

\*Includes IMPLAN sectors for which there is no matching NAICS code. The majority of these impacts are in Owner-occupied Dwellings (\$62 billion) and Other Local Government Enterprises (\$4 billion).

**Figure 11: GDP Impacts of the Top 10 NAICS Industry Sectors resulting from an Energy Price Increase to Energy-Intensive Industries, 2014, (\$ Billions)**



All other Sectors Total GDP Impact: \$5.0 billion

\*Includes IMPLAN sectors for which there is no matching NAICS code. The majority of these impacts are in Owner-occupied Dwellings (\$1.1 billion) and Other Local Government Enterprises (\$0.2 billion).

the oil, natural gas, and electric generation industries.

For example, the model outputs show that higher energy costs in the industrial sector translate to a reduction of purchases from the natural gas distribution sector. However, under the assumption that consumption does not change, these indirect and induced effects do not, in our study, occur. We adjust the outputs to reflect this.

As with the residential sector, the impacts of higher prices on U.S. industries would be felt across a number of sectors. In the figure

below, we show the top 10 most impacted NAICS sectors and the lost GDP opportunity each sector would experience under the higher energy price scenario.

Not surprisingly, several well-known energy-intensive industries are represented on the list of the most impacted sectors below (mostly those in the manufacturing sector). We calculate that the manufacturing sector would stand to lose approximately \$13.1 billion on an annual basis if forced to operate under an EU-level energy pricing regime.

## CITATIONS

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CHAPTER 5  
STATE-LEVEL ANALYSES  
(CO, IL, IN, MI, FL, OH, WI)

# Colorado

The vast majority of the electricity produced in Colorado (more than 80 percent)<sup>1</sup> is derived from coal and natural gas. These lower-than-average generation costs translate into lower-than-average power costs for consumers and businesses in the state, which in turn have contributed to better-than-average economic performance in recent years. In 2014, Colorado generated \$306 billion in GDP<sup>2</sup>, had nearly 2.7 million people active in the workforce and had an unemployment rate of 5.0 percent, which is well below the national average of 6.2 percent.<sup>3</sup>

All told, our analysis indicates that Colorado would see a **\$6.8 billion drop in its state annual economic output** figure under a scenario in which Colorado residents and businesses were forced to live under an EU energy price regime. **More than 84,000 jobs** that would otherwise exist under the energy price regime currently in place in the state would be lost. And all those lost jobs would deprive Colorado families of nearly **\$4 billion in annual**

**wages**, even while forcing those same families (and all the rest as well) to pay nearly **\$4,730 more for their energy per year** than what they already pay. Table 8 summarizes these impacts.

In addition to the impacts described above, we examined the level of potential economic value at risk for the top 25 energy-intensive industries in Colorado. Based on our models, we find that more than 115,000 Colorado jobs would be at risk of leaving the state or being discontinued under an EU energy pricing system, taking with them nearly \$12 billion in annual state GDP.

One specific example of an industry sector in Colorado that could be placed at risk if energy prices were to rise dramatically is the state's brewing industry, which directly contribute \$1.4 billion in annual state GDP (as of 2014). Rather than continue production in Colorado, brewers could move operations to a region with lower energy costs.

**Table 8: Impacts of EU Energy Prices on Colorado Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$6.7 billion	\$125 million	<b>\$6.8 billion</b>
Lost Labor Income	\$3.8 billion	\$74 million	<b>\$3.9 billion</b>
Lost Annual Employment	82,900 jobs	1,300 jobs	<b>84,200 jobs</b>
<b>Annual Energy Cost Increase</b>		<b>\$4,730 per household</b>	

**Table 9: Colorado's Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)
State GDP	\$4.7 billion	\$7.1 billion	<b>\$11.7 billion</b>
Labor Income	\$2.5 billion	\$4.3 billion	<b>\$6.8 billion</b>
Annual Employment	40,600 jobs	75,100 jobs	<b>115,700 jobs</b>

# Illinois



In Illinois, an even greater percentage of the state’s electricity (more than 80 percent)<sup>4</sup> comes from low-cost sources such as coal and natural gas than in Colorado. In large part because of that, Illinois consumers pay less for their electricity than the average U.S. ratepayer (roughly 1.2 cents less per kilowatt-hour).<sup>5</sup> In 2014, Illinois generated \$742 billion in GDP,<sup>6</sup> had nearly 6.1 million people in the workforce and had an unemployment rate of 7.1 percent.<sup>7</sup>

Because Illinois is a bigger state than Colorado, with much more significant industrial activity and greater demand for energy, the impacts that Illinois’s economy would be forced to endure as a consequence of imposing EU-inspired energy pricing are much larger than those we witnessed in Colorado.

For instance, our analysis indicates that imposing EU-level energy prices on Illinois would cost the state **\$174 billion in lost state GDP** and nearly **\$10 billion in lost labor income**.

All told, we find that more than **200,000 jobs** would be lost directly as a result of higher residential and industrial electricity costs. And the per-household cost for Illinois consumers in the form of higher energy bills would amount to **more than \$5,200 per year**. These impacts are summarized in Table 10.

As we did with the other states, we also examined what the potential economic value at risk is for the top 25 energy-intensive industries in Illinois – industries that would be placed at immediate risk of idling, shuttering or moving if they were forced to pay EU-level prices for their energy inputs.

Under such a scenario, we find that nearly **500,000 jobs in Illinois that exist today would be placed at risk of being lost**; nearly \$50 billion in state GDP would be at risk; and more than \$30 billion in annual labor income would be placed in a similarly precarious position.

**Table 10: Impacts of EU Energy Prices on Illinois Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$16.6 billion	\$789 million	<b>\$17.4 billion</b>
Lost Labor Income	\$9.4 billion	\$492 million	<b>\$9.9 billion</b>
Lost Annual Employment	193,600 jobs	7,600 jobs	<b>201,200 jobs</b>
<b>Annual Energy Cost Increase</b>		<b>\$5,230 per household</b>	

**Table 11: Illinois’s Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)
State GDP	\$19.0 billion	\$30.0 billion	<b>\$48.9 billion</b>
Labor Income	\$12.5 billion	\$18.1 billion	<b>\$30.6 billion</b>
Annual Employment	173,700 jobs	319,200 jobs	<b>492,900 jobs</b>



# Indiana

In Indiana, most of the power produced (over 95 percent)<sup>8</sup> comes from low-cost sources such as coal and natural gas; little wonder, then, that Indiana consumers pay less for their electricity than all but 10 states in the country.<sup>9</sup> In 2014, Indiana generated \$324 billion in GDP<sup>10</sup>, had nearly three million people in the workforce and had an unemployment rate of 6.0 percent, which is just below the national average of 6.2 percent.<sup>11</sup>

If residents of the Hoosier State were to wake up tomorrow and find themselves forced to pay EU-inspired prices for their energy, the consequences would be severe.

For starters, our analysis finds that **more than 104,000 jobs would be wiped out**, with the vast majority of those being discontinued as a result of higher residential sector energy costs. Those lost jobs would have the effect of eliminating more than \$4.3 billion in annual labor income, contributing in part to the loss of **\$7.8 billion in annual state GDP**. These impacts, which also include an **extra \$5,450** that Indiana households

will need to pay each year in higher energy costs, are captured in Table 12.

We also examined the potential economic value at risk for the top 25 energy-intensive industries in Indiana, as we did for other states. Our analysis finds that nearly 430,000 jobs would be placed at risk for elimination or departure across the entire spectrum of the state's economy under a scenario in which Indiana was forced to pay EU prices for its energy. **Those lost jobs translate into more than \$26 billion in lost labor income, and a more than \$60 billion hit to the state's annual economic output.**

One sector worth noting in Indiana is the pharmaceutical manufacturing industry, which contributes \$18.7 billion in direct GDP to the state. If energy prices were to rise to European levels, this sector could be at risk. Because of the ripple effect, the total economic value at risk increases up to \$23.4 billion. Table 13 shows the economic value at risk for all of Indiana's top 25 energy-intensive industry sectors.

**Table 12: Impacts of EU Energy Prices on Indiana Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$6.9 billion	\$879 million	<b>\$7.8 billion</b>
Lost Labor Income	\$3.8 billion	\$491 million	<b>\$4.3 billion</b>
Lost Annual Employment	95,800 jobs	8,300 jobs	<b>104,100 jobs</b>
<b>Annual Energy Cost Increase</b>	<b>\$5,450 per household</b>		

**Table 13: Indiana's Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)
State GDP	\$36.3 billion	\$23.9 billion	<b>\$60.3 billion</b>
Labor Income	\$12.0 billion	\$14.2 billion	<b>\$26.2 billion</b>
Annual Employment	134,600 jobs	292,600 jobs	<b>427,200 jobs</b>





# Michigan

In Michigan, over 90 percent of the power produced<sup>12</sup> comes from low-cost sources such as coal and natural gas. In 2014, Michigan generated \$447 billion in GDP<sup>13</sup>, had nearly 4.4 million people in the workforce and had an unemployment rate of 7.3 percent, which is above the national average of 6.2 percent.<sup>14</sup>

All told, our analysis indicates that Michigan would see a nearly **\$12 billion drop** in its state annual economic output under a scenario in which its residents and businesses were forced to live under an EU energy price regime. **Nearly 160,000 jobs** that would otherwise exist at current price levels in the state would be lost. And all those lost jobs would **deprive Michigan families of nearly \$7 billion in annual wages**, making it even more difficult for each Michigan household to pay the **extra \$5,310 per year** to cover higher energy bills. These impacts are summarized in Table 14.

As it relates to the potential economic value at risk is for the top 25 energy-intensive industries in Michigan, the Energy Institute's analysis finds

that more than 520,000 jobs held by Michigan residents today would be at risk of being moved or eliminated under a higher-cost EU energy price regime. Our modeling found that more than **\$52 billion in state GDP** would similarly be placed at risk, along with more than **\$31 billion in labor income** – wages that would be at risk of moving to other lower-cost regions, or disappearing entirely.

One segment of Michigan's economy worth highlighting is its automotive vehicle and parts manufacturing industries, which contributes \$7.7 billion in direct GDP to the state. If energy prices were to rise to European levels, this sector could be at risk (i.e., the industry may stop or move production elsewhere). Because of the ripple effect, the total economic value at risk increases up to \$17.5 billion. Table 15 shows the economic value at risk for Michigan's top 25 energy-intensive industry sectors.

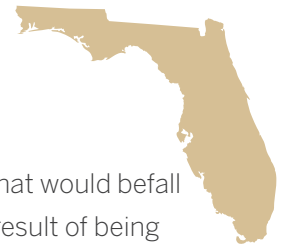


**Table 14: Impacts of EU Energy Prices on Michigan Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$11.0 billion	\$893 million	<b>\$11.9 billion</b>
Lost Labor Income	\$6.3 billion	\$542 million	<b>\$6.8 billion</b>
Lost Annual Employment	150,600 jobs	9,000 jobs	<b>159,600 jobs</b>
<b>Annual Energy Cost Increase</b>		<b>\$5,310 per household</b>	

**Table 15: Michigan's Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)
State GDP	\$22.4 billion	\$29.8 billion	<b>\$52.2 billion</b>
Labor Income	\$12.9 billion	\$18.7 billion	<b>\$31.5 billion</b>
Annual Employment	175,600 jobs	345,400 jobs	<b>521,000 jobs</b>



# Florida

In Florida, most of the power produced (over 95 percent)<sup>15</sup> comes from low-cost sources such as coal and natural gas. In 2014, Florida generated \$836 billion in GDP<sup>16</sup>, had more than nine million people in the workforce and had an unemployment rate of 6.3 percent, which right near the national average of 6.2 percent.<sup>17</sup>

When we ran the numbers for Florida, we found that **more than 377,000 jobs** that presently exist in the Sunshine State would be lost if EU energy prices were imposed on its economy. Nearly **\$30 billion in annual state economic output** would also be lost, and workers in the state would collect about **\$16 billion less in wages** than they might have otherwise done. Especially concerning given the state's high percentage of fixed-income residents, the average Florida household would be forced to pay **nearly \$5,000 more per year** for their energy than what it currently pays. These impacts are summarized in Table 16.

Similar to the negative impacts that would befall the Florida economy as a direct result of being forced to pay higher, EU-style residential and consumer energy prices, the potential economic value at risk for the top 25 energy-intensive industries in Florida is similarly enormous. For example, our analysis found that nearly 340,000 Florida jobs would be put at risk under this scenario, potentially resulting in the loss of more than \$18 billion in wages, and **costing the economy more than \$31 billion in state GDP**.

One sector worth highlighting is Florida's semiconductor manufacturing industry, which contributes \$1.7 billion in direct GDP to the state. If energy prices were to rise to European levels, this sector could be at risk for closure. Accounting for the ripple effect, the total economic value at risk increases to \$4.2 billion. Table 17 summarizes these impacts.

**Table 16: Impacts of EU Energy Prices on Florida Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$28.0 billion	\$455 million	<b>\$28.5 billion</b>
Lost Labor Income	\$15.6 billion	\$272 million	<b>\$15.9 billion</b>
Lost Annual Employment	372,400 jobs	5,000 jobs	<b>377,400 jobs</b>
<b>Annual Energy Cost Increase</b>		<b>\$4,980 per household</b>	

**Table 17: Florida's Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)
State GDP	\$11.8 billion	\$19.9 billion	<b>\$31.7 billion</b>
Labor Income	\$6.4 billion	\$11.8 billion	<b>\$18.2 billion</b>
Annual Employment	105,100 jobs	233,700 jobs	<b>338,800 jobs</b>



# Ohio

Almost all of the power produced in Ohio (96 percent)<sup>18</sup> comes from conventional and low-cost sources – coal, natural gas, and nuclear. Ohio is also a major manufacturing state – the manufacturing sector alone represents 17 percent of Ohio’s GDP, generates more than 660,000 jobs, and chips in \$36 billion in labor income.<sup>19</sup> Ohio generated \$576 billion in GDP in 2014<sup>20</sup>, had nearly 5.4 million people employed, and had an unemployment rate of 5.7 percent, below the national average of 6.2 percent.<sup>21</sup>

Ohio’s economy is on track to continue its growth, with significant growth coming from oil and natural gas development, including from unconventional sources.<sup>22</sup> Under European-style energy policies that make fossil fuels more expensive and/or harder to produce, Ohio households and businesses would suffer major economic impacts.

Those impacts start with jobs: under this new pricing regime, **Ohio would lose more than 187,000 jobs, and \$8.2 billion in wages being paid out to Ohio workers today** would also be eliminated. All told, the state’s annual economic output would **decline by a staggering \$14.8**

**billion.** Our analysis of energy price increase impacts to Ohio (including the **extra \$5,000** that Ohio households would have to pay for their energy, over and above what they already pay today) is represented in Table 18.

As with the other states we analyzed, we examined what the potential economic value at risk would be for the top 25 energy-intensive industries in Ohio. Similar in many ways to the industrial profile on display in Michigan, Ohio’s economy would stand to lose more than 512,000 jobs if EU energy prices became the norm there. Those lost jobs put nearly \$30 billion in wages at risk, and have the potential to deprive Ohioans of more than \$57 billion in annual state GDP.

One segment worth noting in Ohio is its iron and steel manufacturing sector, which contributes \$2.2 billion in direct GDP to the state. If energy prices were to rise to European levels, this sector could be at risk (i.e., the industry may stop or move production elsewhere). Because of the ripple effect, the total economic value at risk increases to \$5.8 billion. Table 19 shows the economic value at risk for Ohio’s top 25 energy-intensive industry sectors.

**Table 18: Impacts of EU Energy Prices on Ohio Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$13.3 billion	\$1.5 billion	<b>\$14.8 billion</b>
Lost Labor Income	\$7.4 billion	\$807 million	<b>\$8.2 billion</b>
Lost Annual Employment	173,700 jobs	13,500 jobs	<b>187,200 jobs</b>
<b>Annual Energy Cost Increase</b>	<b>\$5,000 per household</b>		

**Table 19: Ohio’s Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)
State GDP	\$27.7 billion	\$29.5 billion	<b>\$57.2 billion</b>
Labor Income	\$12.1 billion	\$17.8 billion	<b>\$29.9 billion</b>
Annual Employment	169,400 jobs	343,400 jobs	<b>512,800 jobs</b>



# Wisconsin

Wisconsin's economy has recovered more quickly than that of other states coming out of the recession of 2009. In 2014, the state generated \$290 billion in GDP<sup>23</sup>, had more than 2.9 million people employed, and had an unemployment rate of 5.5 percent, below the national average of 6.2 percent.<sup>24</sup>

A large part of Wisconsin's economic success is related to its lower energy costs. Nearly 90 percent<sup>25</sup> of the electric power in Wisconsin comes from conventional and low-cost sources – coal, natural gas, and nuclear. The state's manufacturing sector is a large consumer of electricity, and the sector represented nearly 19 percent of the state's GDP in 2014 and accounted for more than 16 percent of the state's workforce in 2015. Average annual compensation in Wisconsin's manufacturing sector was more than \$67,000 per employee in 2015.<sup>26</sup>

Wisconsin's economic outlook in more recent years, however, has slightly dimmed. Ranked as 38<sup>th</sup> in job creation, the state has been lagging other states.<sup>27</sup> Wisconsin's economy could be under even greater pressure if European-style energy policies were to be imposed there. Our analysis finds that **more than 81,000 jobs** would be lost under such a scenario, along with **\$3.5 billion in lost annual wages and a hit to the**

## state GDP approaching \$6.3 billion per year

Critically, Wisconsin households would have to pay **\$4,720 more per year** for their energy than they already do. Table 20 summarizes these impacts.

As with the other states, we examined what the potential economic value at risk is for the top 25 energy-intensive industries in Wisconsin. Here again, our models point to hundreds of thousands of jobs being placed at risk if EU energy prices were to be imposed on the broader economy. We found that nearly 450,000 jobs that currently exist today would be put at risk for elimination; \$25 billion in labor income each year could potentially be lost; and greater than \$40 billion in annual state GDP could potentially be wiped out.

In Wisconsin, the state's cheese manufacturing sub-sector is a key sector worth noting, as it contributes over \$1.5 billion in direct GDP and nearly \$9.7 billion in GDP to the state via its economic ripple effect. In fact, the cheese manufacturing sub-sector represents approximately one-quarter of the GDP value at risk of Wisconsin's top 25 energy-intensive industry sectors (Table 21).

**Table 20: Impacts of EU Energy Prices on Wisconsin Economy (2014)**

Economic Impact	Higher Residential Energy Prices	Higher Industrial Energy Prices	Total Impact
Lost State GDP	\$5.5 billion	\$805 million	<b>\$6.3 billion</b>
Lost Labor Income	\$3.0 billion	\$496 million	<b>\$3.5 billion</b>
Lost Annual Employment	72,900 jobs	8,600 jobs	<b>81,500 jobs</b>
<b>Annual Energy Cost Increase</b>	<b>\$4,720 per household</b>		

**Table 21: Wisconsin's Industrial Value at Risk Under EU Price Regime (2014)**

Economic Impact	Industrial Value at Risk (Direct Impact)	Industrial Value at Risk (Additional Impact)	Industrial Value at Risk (Economy-Wide Impact)	Cheese Manufacturing Share of the Top 25
State GDP	\$15.8 billion	\$24.9 billion	<b>\$40.6 billion</b>	24 percent
Labor Income	\$10.4 billion	\$14.6 billion	<b>\$25.1 billion</b>	21 percent
Annual Employment	161,400	286,500 jobs	<b>447,800 jobs</b>	21 percent

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# TECHNICAL APPENDIX

This technical appendix describes the economic impact modeling data, assumptions, and methodology for both our Residential and Industrial sector analysis.

Gasoline prices on the cover were calculated by comparing the U.S. average price for regular unleaded gasoline on 9-28-16 (\$2.21 per gallon) with an average of price for Super 95 unleaded gasoline in each of the 28 European Union countries in mid-September (1.24 €/liter = \$5.24/gallon). Assumes a 20-gallon gas tank.

## RESIDENTIAL MODELING ASSUMPTIONS & DATA

To model the overall macroeconomic impact of higher energy prices, we use annual data for the year 2014. We model 2014 because it is the year in which all data is available. We rely on the following data for the analysis:

- **US Energy Prices** — Energy Information Administration (EIA).<sup>1</sup> Data tables include:
  - **Average Electricity Price by State by Provider**<sup>2</sup> — We use “Residential” and “Industrial” (for industrial analysis) columns under the “Total Electric Industry” Industry Sector Category for prices.
  - Natural gas price delivered to residential consumers<sup>3</sup>
  - Natural gas industrial price<sup>4</sup> (for industrial analysis)
  - All grades all formulations retail gasoline prices<sup>5</sup>
  - No 2 Diesel prices<sup>6</sup>
- **European Energy Prices**
  - European Commission’s Eurostat.<sup>7</sup> We use data for the EU 28 countries throughout the analysis because it is the most consistent aggregate. Data tables include:
    - Electricity prices by type of user<sup>8</sup> - the data is broken down by “Medium size household” and “Medium size industrial” (for industrial analysis)
    - Natural gas prices by type of user<sup>9</sup> - the data is broken down by “Medium size household” and “Medium size industrial” (for industrial analysis)
  - European Environment Agency (EEA).<sup>10</sup>
    - This data provides motor fuel prices. We use the “All petrol, unleaded equivalent (nominal)” column for gasoline prices. We use the “Diesel (nominal)” column for diesel prices.
- **Historical Exchange Rates:** U.S. Internal Revenue Service (IRS).<sup>11</sup>
- **US Residential Energy Spending:** Bureau of Labor Statistics (BLS) Consumer Expenditure Survey for year 2014.<sup>12</sup> Data tables include:



- “Income before taxes”<sup>13</sup> and “Higher income before taxes”.<sup>14</sup> From these two data sets, we rely on the following:
  - Average (mean) natural gas expenditures by income level
  - Average (mean) electricity expenditures by income level
  - Average (mean) gasoline and motor oil expenditures by income level

### CALCULATIONS & ASSUMPTIONS

To run our IMPLAN model, we assume that the additional energy costs come in the form of lost consumer income. Our approach took the following steps:

1. Calculate the price difference between EU and U.S. prices for electricity, natural gas, and motor fuels.
  - a. Because the BLS data aggregates “Gasoline and motor oil” as an expenditure line item, we use a weighted average of the Gasoline and Diesel percent difference. The weighted average is based on EIA data for “product supplied for finished gasoline” and “No 2 diesel fuel sales/deliveries to On-highway customers” consumption figures.<sup>15</sup>
  - b. TA-Table 1 shows the difference in prices:

**TA-Table 1: Residential Energy Price Differential Impacts, 2014**

	US Price (USD/unit)	EU Price (USD/unit)	% Difference
<b>Industrial</b>			
Electricity (MWh)	\$71.00	\$116.96	<b>165%</b>
Natural Gas (mcf)	\$5.55	\$13.50	<b>243%</b>

2. We apply the values in the table above to the average annual expenditure by energy type for each income level in the BLS survey data described above. For example, consumers in the <\$5,000 income bracket spent an average of \$201 on natural gas in 2014. For this analysis, we multiply this expenditure amount by the 227 percent difference from the table above to calculate a new expenditure value of \$457 for this income bracket.
  - a. We assume that under the higher price scenario, consumption would stay constant. Implicitly, we are assuming that Americans would continue to have the same lifestyle (i.e., large homes, road miles traveled, etc.) under higher energy prices. Of course, demand isn’t completely inelastic, but for simplicity and the purposes of this analysis, we assume it is.
3. After running the calculation above for each of the BLS income levels, we then group the income levels to match the income level breakdown in PLEXOS.<sup>16</sup> TA-Table 2 shows the final results of this calculation.

**TA-Table 2: Average Residential Electricity, Natural Gas, and Motor Fuel Expenditure by Income Level, 2014, (\$ Billions)**

Income Bracket	2014 Actual Expenditure	Increased Price Scenario	Difference
Less than \$10k	\$25.5	\$53.3	-\$27.8
10k to 15k	\$20.1	\$42.1	-\$22.0
15k to \$25k	\$48.8	\$102.0	-\$53.3
\$25 to \$35k	\$76.2	\$159.4	-\$55.8
\$35k to \$50k	\$73.3	\$153.4	-\$80.1
\$50k to \$75k	\$102.4	\$214.2	-\$111.8
\$75k to \$100k	\$71.7	\$150.1	-\$78.4
\$100k to \$150k	\$88.9	\$186.1	-\$97.2
\$150k and more	\$76.0	\$159.4	-\$83.4
<b>Total</b>	<b>\$582.8</b>	<b>\$1,219.9</b>	<b>-\$609.7</b>

4. Finally, once we calculate how much additional consumer expenditures would have been under energy prices that mirror those of the EU, we are able to run IMPLAN. The values in the table above are input into the U.S. national IMPLAN model for the year 2014 as a change in Household Income.

### INDUSTRIAL MODELING ASSUMPTIONS & DATA

We relied on the following data to model the Industrial sector:

- **US Energy Prices** — Energy Information Administration (EIA) as described in Residential section.<sup>17</sup>
- **European Energy Prices** — European Commission's Eurostat as described in Residential section.<sup>18</sup>
- **Historical Exchange Rates:** U.S. Internal Revenue Service (IRS).<sup>19</sup>
- **US Industrial Energy Spending:**
  - Used the US Census Annual Survey of Manufacturers (ASM)<sup>20</sup> data from 2014 to identify electricity spending and fuel spending for each of the manufacturing industry codes in IMPLAN.
    - Matching was done by industry name; which corresponds to NAICS codes at the 4-, 5- and 6-digit levels.
  - Used the EIA's Manufacturing Energy Consumption Survey (MECS) to determine the percentage of total fuel spending that natural gas represents.<sup>21</sup>
    - Data is from 2010 (most recent year available)

- MECS data is aggregated for some industries. Where data were not available for detailed industries (5-digit or 6-digit NAICS), more aggregated data were used. For example, MECS data were not available for Plastics Packaging Materials (NAICS 32611), so we used data for Plastics and Rubber Products (NAICS 326).

### CALCULATIONS & ASSUMPTIONS

To calculate the impact of higher energy prices in the industrial sector, we took the following steps:

1. We ranked the top 25 industries based on total electricity and fuel spend from the ASM.
2. We increased the electricity and natural gas spend for the 25 industries by the percentage increase calculated for the Industrial sector.
  - a. We use the EIA data described above for prices (see Residential Data section above). We run the same calculation to compare US and EU prices. The results of this calculation are shown in TA-Table 3.

**TA-Table 3: Industrial Energy Price Differential Impacts, 2014**

	US Price (USD/unit)	EU Price (USD/unit)	% Difference
<b>Residential</b>			
Electricity (MWh)	\$125.2	\$259.31	<b>207%</b>
Natural Gas (mcf)	\$10.97	\$24.94	<b>227%</b>
Motor Fuels (gallons)			
<i>Gasoline</i>	\$3.44	\$7.42	<b>216%</b>
<i>Diesel</i>	\$3.83	\$6.77	<b>177%</b>
<i>Wtd. Gas &amp; Diesel</i>			<b>207%</b>

3. For each industry we reduced the Proprietor Income in IMPLAN to reflect the increase in energy expenses.

## Notes

- 1 See <http://www.eia.gov/>
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- 14 <http://www.bls.gov/cex/2014/combined/higherincome.xlsx>
- 15 See [https://www.eia.gov/dnav/pet/pet\\_cons\\_psup\\_a\\_EPM0F\\_VPP\\_mbb1\\_a.htm](https://www.eia.gov/dnav/pet/pet_cons_psup_a_EPM0F_VPP_mbb1_a.htm) and [https://www.eia.gov/dnav/pet/PET\\_CONS\\_821USE\\_A\\_EPD2D\\_VHN\\_MGAL\\_A.htm](https://www.eia.gov/dnav/pet/PET_CONS_821USE_A_EPD2D_VHN_MGAL_A.htm)
- 16 For example, the BLS survey data has income levels broken down (for the most part) by \$5,000 increments (e.g., \$15,000-\$19,999). Some of the increments fit within the income levels described in Table 2, but others do not. As an example, the BLS survey has expenditure data for the \$15,000-\$19,999 and \$20,000-\$29,999 ranges. To get the total expenditure into the IMPLAN bucket of \$15-\$25k, we take all of the expenditures from the \$15,000-\$19,999 range plus half of the expenditures in the \$20,000-\$29,999 range.
- 17 See <http://www.eia.gov/>
- 18 <http://ec.europa.eu/eurostat>
- 19 <https://www.irs.gov/Individuals/International-Taxpayers/Yearly-Average-Currency-Exchange-Rates>
- 20 <http://factfinder.census.gov/bkmk/table/1.0/en/ASM/2014/31GS101>
- 21 [https://www.eia.gov/consumption/manufacturing/data/2010/xls/Table3\\_3.xls](https://www.eia.gov/consumption/manufacturing/data/2010/xls/Table3_3.xls)



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