2016 EDITION

INTERNATIONAL INDEX OF ENERGY SECURITY RISK®

ASSESSING RISK IN A GLOBAL ENERGY MARKET

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Foreword

In this, the fourth edition of the International Index of Energy Security Risk, once again the big story is how the shale revolution in the United States has changed the U.S. and the global energy security landscape for the better.

It was not all that long ago, in March 2012, that President Obama declared in his weekly address to the nation, "But you and I both know that with only 2% of the world's oil reserves, we can't just drill our way to lower gas prices – not when we consume 20 percent of the world's oil."

Apparently, U.S. industry did not get the word. From the end of 2011, a few months before the president made that claim, to 2015, U.S. crude oil production jumped by 3.8 million barrels per day, an astonishing two-thirds higher, with production from Texas, North Dakota, Oklahoma, and Colorado leading the way.

This rising output from North America (Canada, too, increased it oil output substantially (about 800,000 barrel per day) over this time period) came during a time of rising tensions in the Middle East, supply disruptions, and increasing demand from large emerging economies like China that normally would squeeze spare global oil production capacity and send prices sky-high. It did not happen.

In fact, we have seen just the opposite—prices plunging buy more that 50% in the span of a few months. How did this happen? North American producers proved so good at finding and producing oil, and thus reducing the need for imports, that Saudi Arabia, the Organization of Petroleum Exporting Countries' swing producer, felt compelled to abandon its defense of a $100+ price for a barrel of oil and go for market share instead, adding even more oil to world markets.

While every country in our International Index has enjoyed the benefits of very low oil price volatility over the past few years, in the next edition we are likely to see volatility risks increase as a result of this steep drop in prices. This is no surprise as large and rapid price swings, both up and down, are disruptive and can create economic dislocations, as we are seeing in the United States, with job losses in the oil and natural gas sector.

Nevertheless, it is entirely possible—indeed, probable—that in the not-to-distant future we will see oil prices stabilize, and at level much lower than $100 per barrel. And it is also likely we will see lower natural gas prices becoming the new normal globally.

If in increasing production the Saudi's hope was to kill the U.S. shale industry, it has not worked.

The reason is that U.S. energy producers are incredibly nimble, and through the use of advanced technologies, they are able to lower constantly the price point at which oil and natural gas can be produced profitably. If in increasing production the Saudi's hope was to kill the U.S. shale industry, it has not worked. It is true that many companies find themselves in trouble and production is slipping, as is the number of rigs being deployed. The fact remains, 3 however, that U.S. producers are so skillful at what they do that they will be able to ramp up production on short notice at the first indication of rising prices.

While it is likely, therefore, that we will see some firming of oil prices, it is unlikely that they will breech $100 per barrel anytime soon. So while U.S. oil and natural gas firms may be not be able to stop a severe drop in price, they can and probably will prevent a severe run up in price. The lifting of the ban on

crude oil exports also should result in greater U.S. participation in global oil and natural gas markets on the supply side to limit the use of energy as a geopolitical weapon and smoothing out volatility.

Lower oil and natural gas prices globally, combined with already comparatively low coal prices, will provide a great deal of economic relief, especially for countries dependent on imports for a large portion of their energy usage. Take Japan, for instance. While it has been forced to import even greater amounts of fossil energy after it shut down its nuclear power generating capacity in response to the Fukishima Daichii incident, significantly lower energy costs should see its foreign energy expeditures drop significantly, an important consideration for such an import-dependent country.

Even as countries enjoy lower prices, the comparative energy price differential among countries detailed later in this report remains, and it is a growing concern in many countries seeking to maintain important industries. American industry pays two to four times less for natural gas, coal, and electricity than many of its global competitors, especially those in Europe and Japan, a difference that is helping to drive a U.S. manufacturing revival.

The situation in Europe is much different and provides a cautionary tale. Regulatory structures—including the Emissions Trading System, taxes, user fees, large subsidies, and mandates—all conspire to make Europe's electricity prices among the highest in the world. Exorbitant energy prices are turning Europe's energy-intensive industries into endangered species. Because high-priced energy weighs more heavily on energy intensive industries such as chemicals, manufacturing, and steel, it is forcing many trade-exposed companies in these sectors to shift production overseas. Indeed, more and more we are seeing European companies closing up shop and fleeing to other countries, including the United States, with lower energy costs.

Consider the plight of the United Kingdom's steel industry. Mumbai, India-based Tata Steel, one of the world's largest steel concerns, announced that it will be shutting down it last UK facility, citing "cripplingly high electricity costs" as one of the factors in it decision. This came on top of the decision by the UK affiliate Thailand-based SSI to mothball one of its plants. It too cited energy costs as a reason for the closure. The steel industry in Germany has voiced similar concerns about the high cost of energy. Meanwhile, Voestalpine and Benteler, two Austrian steel companies, are building mills in Texas and Louisiana to take advantage of lower U.S. energy costs.

More and more we are seeing European companies closing up shop and fleeing to other countries, including the United States, with lower energy costs.

And it is not just steel. The European aluminum and chemical industries also are feeling the effects of hefty energy costs. Since 2009, for example, there have been more than 20 chemical plants closures in the United Kingdom and no new builds. A similar situation prevails in Germany, where large chemical companies and other energy-intensive industries are shifting investment away from Germany to the United State. A recent German Chamber of Commerce survey that found nearly a quarter of all companies in heavy industry are considering reducing production in Germany.

Granted, there are other considerations in play. Excess Chinese steel output, for example, was already straining the UK steel industry, but higher energy costs have not made it any easier to compete.

The irony in all of this from the U.S. perspective is the attitude of the Obama Administration, which appears more than willing to relinquish America's energy edge by raising energy prices on American consumers and industry. The president's call for new taxes and regulations on oil and natural gas production, not to mention U.S. Environmental

Protection Agency's Clean Power Plan—which the Supreme Court wisely put on hold—would saddle consumers and businesses with significantly higher energy costs. America's energy revolution has not only improved the nation's energy security posture vis-à-vis other countries—we moved from a ranking of number six to number four in 2014—it has given U.S. business a critical leg up in today's intensely competitive global economy.

There is a lesson in this for America. We have a huge energy advantage. Why would we want to throw it away?

Karen A. Harbert
President and CEO
Institute for 21st Century Energy
U.S. Chamber of Commerce

Acknowledgements

The International Index could not have been completed without the extraordinary efforts of many people. In particular, our thanks go to Daniel E. Klein, President of Twenty-First Strategies of Santa Fe, New Mexico, and his assistant, Christopher D. Russell, for their diligence and acumen in designing and updating the international database that crunches the numbers and the delivers the results. Energy Institute interns Mallory Richardson from The George Washington University and Thomas Lahey from The Catholic University of America also were instrumental in scrubbing the data, formatting the data for publication, and researching country updates. The entire production team here at the U.S. Chamber of Commerce, led by Brian Miller, is owed a huge debt of gratitude for designing and producing the publication under a tight deadline. Finally, special thanks go to the entire Energy Institute team for creating a first-of-its-kind energy security risk index that is changing the way people view and talk about energy security.

Highlights

This fourth edition of the International Index of Energy Security Risk (International Index) provides an updated look at energy security risks across different countries for the years 1980 through 2014. The risk index scores calculated for the United States and 24 other countries that make up the Index's large energy user group: Australia, Brazil, Canada, China, Denmark, France, Germany, India, Indonesia, Italy, Japan, Mexico, Netherlands, Norway, Poland, Russian Federation, South Africa, South Korea, Spain, Thailand, Turkey, Ukraine, and the United Kingdom. The scores for these countries are reported in relation to an average reference index measuring risks for the Organization for Economic Co-operation and Development (OECD) member countries. The OECD average risk index is calibrated to a 1980 base year figure of 1,000.

2014 Energy Security Rankings

Table H-1 ranks the energy security scores of 25 large energy-consuming countries in 2014. This is a risk index, so keep in mind that the highest (best) rank has the lowest numerical risk score and the lowest (worst) rank the highest numerical risk score.

Top Five

Norway remains the most energy secure country in the large energy user group in 2014. It has held the top spot since 2006, and since 1980 it has never been out of the top five. Its total risk score of 733 is 16% below the OECD average score of 869 and the gap between it and the OECD has widened somewhat in recent years. Looking at the metrics individually, of the 20 "country-specific" metrics used in the Index, Norway scores in the top five in 11 of them, with only three in the bottom five. Mexico—which earned a number one ranking from 1980 to 1994—was the second ranked country with a score of 766. From 1980 to the early 2000s, Mexico's risk scores rose steadily in relation to the OECD baseline average, but this trend seems to have flattened. For the entire period from 1980 to 2014, only three countries have occupied the top spot —Mexico, Norway, and the United Kingdom. At numbers three, four, and five, respectively, New Zealand, United States, and Denmark occupy the other top five spots in the ranking list for 2014.

Bottom Five

With a risk score of 1,944—124% greater than the OECD average—Ukraine continues to be the least energy secure country in the 25-nation large energy user group in 2014. Ukraine has not moved out of the 25th spot since 1992, with soaring risks averaging 175% above the OECD average since 1992, the first year of Ukraine data. Nevertheless, the country's risk scores have declined significantly from their 1995-1996 peak of just over 2,600, both in absolute terms and in relation to the OECD average. The country's scores are still extraordinarily high—about one-fifth higher than 24th-ranked Thailand—that much greater progress will be needed for the Ukraine to break out of the bottom position. Political turmoil in the country, however, could frustrate policies aimed at improving its energy situation. Thailand, Brazil, South Korea, and China, all with scores exceeding 1,200, make up the rest of the bottom five.

United States[1]

The United States moved up two places to number four in 2014. The shale revolution continues to drive total U.S. energy risks downward, both absolutely and measured against the OECD average. Since 2000, the United States has improved its energy security relative to the OECD average, going from a total score 8% greater than to 5% less than the OECD average in 2014. Over the same period, its rank rose from 10 to 4. This vastly improved U.S. position in reference to its peers is due primarily to the huge increase in

1 It should be emphasized that the index data presented here and the index data presented in the Energy Institute's *Index of U.S. Energy Security Risk* measure different things and are not strictly comparable, though the general trend is substantially the same. Moreover, the concern in this section is primarily with U.S. energy security risks in reference to those of the OECD average and other large energy users over time.

Table H-1. Energy Security Risk Scores and Rankings for 25 Large Energy Using Countries: 2014

Country	Risk Score	Large Energy User Group Rank
Norway	733	1
Mexico	766	2
New Zealand	799	3
United States	824	4
Denmark	827	5
United Kingdom	828	6
Canada	832	7
OECD	869	
Australia	903	8
Germany	930	9
France	932	10
Poland	959	11
Spain	1,017	12
Italy	1,038	13
Turkey	1,064	14
Japan	1,068	15
Netherlands	1,091	16
Indonesia	1,123	17
South Africa	1,185	18
India	1,186	19
Russia	1,192	20
China	1,212	21
South Korea	1,290	22
Brazil	1,297	23
Thailand	1,627	24
Ukraine	1,944	25

unconventional oil and natural gas production from shale formations. The United States is one of 16 countries with a 2014 risk score lower than its 1980 score, nearly 250 points, or 23%, lower. This is a larger relative reduction than for all of but two countries: China (40%) and Denmark (34%). The best score for the United States in the International Index was 801 in 1998. Of the 20 country-specific metrics, the U.S. ranks in the top five in four of them (related to import risks and energy expenditures and prices) and the bottom five in three of them (related to per capita energy use).

Movers

All countries showed improved risk scores in 2014, and position the relative positions among them did not change appreciably in 2014. The United States and Australia showed the largest single-year improvement in their energy security rank, both climbing two places to number four and number eight, respectively. These two countries were among those with the biggest percent improvement in absolute risk scores in 2014, largely on the strength of the improving imports posture of both.

Russia, on the other hand, saw its 2014 score improve the least as a percentage (2%) compared to the other 24 countries, with climbing risks in the transportation and environmental sectors in 2014 being the primary factors. As a result, Russia moved two places lower to 20th position.

Key Developments

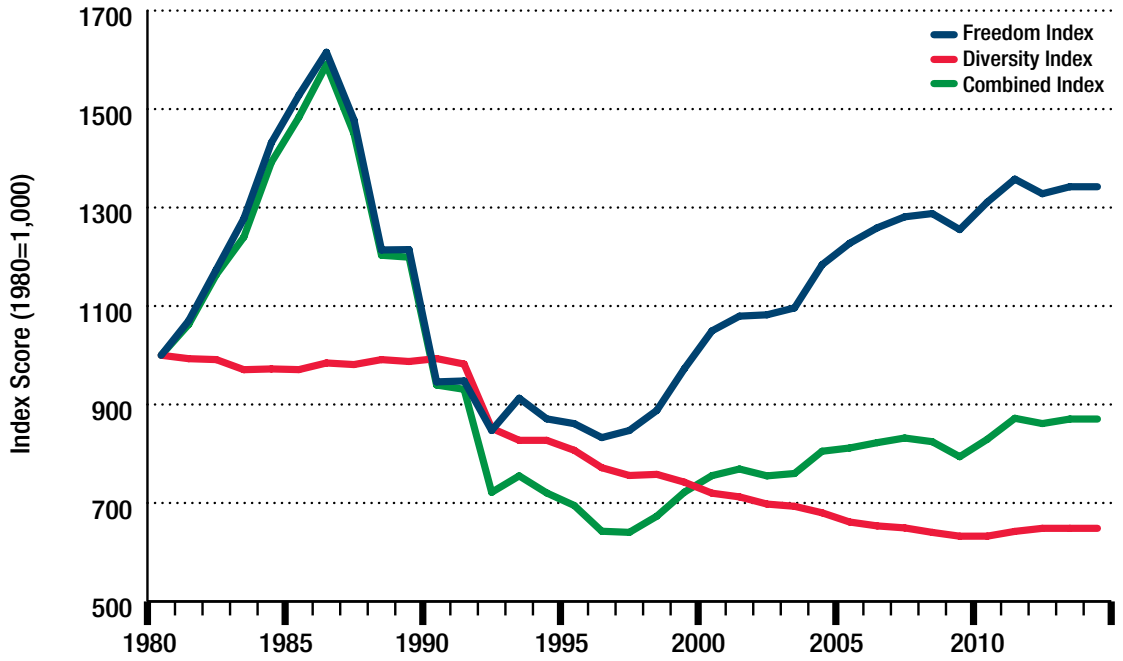
Energy security risks for all countries in the large energy user group and for the OECD average fell in 2014, primarily because of much lower crude oil price volatility. This is the fourth consecutive year of declining volatility. Volatility can have profound effects on economies. Some amount of price volatility is inevitable, but large price swings over a short period of time create uncertainty about expectations of future prices. Highly volatile prices not only can jolt economies, they can lead to sudden and large shifts in international trade flows. In 2014, crude oil price volatility, measured as the three-year rolling average of annual change in price, was just below $7 (in real 2014 dollars), its lowest level since 2004. This is well below the historical peak of nearly $30 set in 2011. As a result, from 2011 to 2014, the index for this measure dropped a whopping 1,405 points to a score of 419. No other metric moved nearly as much in 2014. Because crude oil is priced in a global market, price volatility is a "shared" risk that applies equally to all countries. That means the 46% decline measured for this risk in 2014 benefits everyone. This marks the fourth year of declining price volatility. The sharp decline in crude oil prices that began in 2014, however, means that we can expect to see price volatility rising in the next report. Indeed, the year-to-year change in the price of crude oil jumped from about $4.50 in 2013 to $13.00 in 2014, and indication of the higher volatility to come in 2015.

The recent decision by Saudi Arabia to sustain a high production level despite depressed global crude oil prices to capture greater market share has resulted in tremendous price volatility during 2014 and 2015. Oil prices dropped sharply from more than $100 per barrel to below $50 per barrel. This strategy was aimed in large part at taking out as much U.S. production off the market as possible. Under a prolonged period of low oil prices, it was believed U.S. oil and natural gas production would be constrained.

Global crude oil production surged nearly 1.6 million barrels per day (bbl/d) in 2014. An increase in U.S. output of 1.2 million bbl/d, largely from "unconventional" sources, was primarily responsible for the jump. Greater production in Iraq (315,000 bbl/d), Canada (280,000 bbl/d), Brazil (230,000 bbl/d), and Iran (120,000 bbl/d) also contributed to the overall rise. The increase from these countries was more than enough to offset the declining oil output from a politically unstable Libya (450,000 barrels per day) and Mexico (105,000 bbl/d). The Mexican decline is a continuation of a long-term trend the Mexican government hopes will be reversed as a result of its liberalization of investment in its hydrocarbon sector can be reversed.

The decreasing risk associated with greater supply diversity of natural gas production has been offset to a large extent by increases in production from countries with high risk profiles, such as Russia, Iran, Qatar, and Algeria. Figure H-1 shows how the production risk related to diversity of supply has seen steady, if unspectacular, improvement since the early 1990s.Two things are going on here: (1) the breakup of the Soviet Union created more natural gas producers

Figure H-1. Security of Global Natural Gas Production Risk Index: 1980-2014



(if not necessarily more natural gas production); and (2) increased output in places that did not produce much natural gas previously. For example, in 1990 there were 11 countries producing at least 1 quadrillion Btus of natural gas. Today there are 26. As Figure H-1 also shows, however, the freedom-weighted score attached to the average molecule of natural gas supplied to the market—a proxy for supply reliability—has since the early 1990s deteriorated because many of the producers who increased output have large reliability risk attached to them. (A not dissimilar pattern holds for crude oil output, but it is not as pronounced.)

As a result, natural gas import risks remain very high for many countries, especially in Europe and in Japan and South Korea. Large gas-producers in the large energy user group like Australia, Canada, Russia, the United States, and a few others have a tremendous advantage over countries that rely on imports of this fuel. Once forecast to be a large natural gas importer, the U.S. is now poised shortly to become a net natural gas exporter, which should not only improve the reliability of supplies but also the diversity of supplies. There also are abundant shale gas resources outside the United States, many of which are in large energy user group countries (Table H-2). China, for example, has potentially the world's largest shale gas resource (followed by Argentina and Algeria). Australia, Canada, Mexico, Russia, and South Africa are others countries with very large resources. As these resources are developed, we can expect to see natural gas supply risks lower, but that could take many years. In the shorter term, growing output from Australia and the United States, in particular, will have a moderating effect on risk.

There continues to be a wide divergence in retail electricity prices, with those countries showing the highest risk being found largely in Western Europe, a trend that has increased the relevance of economic competitiveness in discussions of energy policy. Seven of the bottom 10 countries for this metric in the large energy user group are located in Western Europe, while only one European country—Norway, which relies heavily on hydropower—is in the top 10 (and at number 10, just barely). Electricity prices in much of Western Europe and Japan have increased sharply in recent years and are now among the highest in the world, creating competitive pressures on industry. Brazil and Turkey are the only emerging economies with retail electricity prices in the bottom 10.

Table H-2. Estimated World Shale Resources

Region/Country	Unproved Technically Recoverable	
	Wet Shale Gas (trillion cubic feet)	Tight Oil (billion barrels)
North America		
Canada	573	9
Mexico	545	13
United States	623	78
Australia		
Australia	429	16
South America		
Argentina	802	27
Bolivia	36	1
Brazil	245	5
Chile	49	2
Colombia	55	7
Paraguay	75	4
Uruguay	5	1
Venezuela	167	13
Eastern Europe		
Bulgaria	17	0
Lithuania	2	1
Poland	146	2
Romania	51	0
Russia	285	75
Turkey	24	5
Ukraine	128	1
Western Europe		
Denmark	32	0
France	137	5
Germany	17	1
Netherlands	26	3
Norway	0	0
Spain	8	0
Sweden	10	0
United Kingdom	26	1
North Africa		
Algeria	707	6
Egypt	100	5
Libya	122	26
Mauritania	0	0
Morocco	12	0
Tunisia	23	2
West Sahara	9	0
Sub-Saharan Africa		
Chad	44	16
South Africa	390	0
Asia		
China	1,115	32
India	96	4
Indonesia	46	8
Mongolia	4	3
Pakistan	105	9
Thailand	5	0
Caspian		
Kazakhstan	28	11
Middle East		
Jordan	7	0
Oman	48	6
United Arab Emirates	205	23
Total	7,577	419

Source: Energy Information Administration, World Shale Resource Assessments.

The use of affordable coal for power production in North America, Australia, and Asia, plus cheap natural gas in the North America, has kept electricity prices comparatively low in these regions. Large-scale hydropower, especially in Canada and Norway, also has contributed to lower electricity prices. Figures H-2 and H-3 show the large divergence in energy prices for selected OECD countries that are in the large energy user group.

Figure H-2.
Electricity Prices for Households: 2014

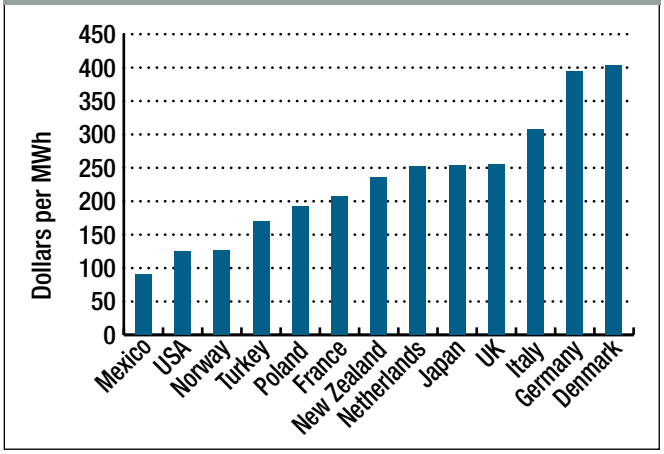
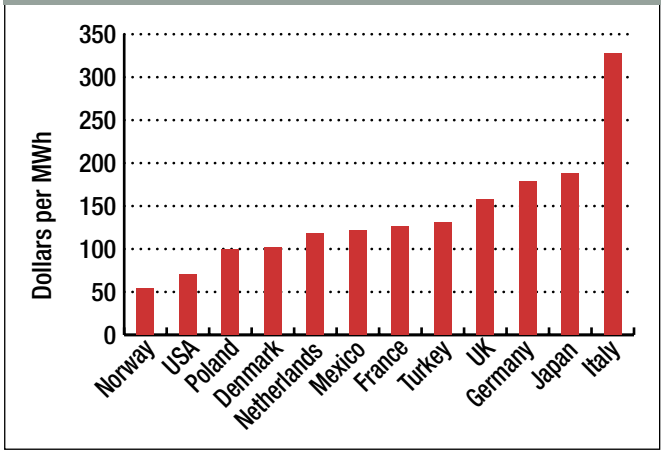


Figure H-3.
Electricity Prices for Industry: 2014



Source: International Energy Agency, Key World Energy Statistics 2015.

Fossil fuels will continue to be the primary global source of energy for decades to come, and coal will be the primary fuel for electrification. Fossil fuels currently provide about 85% of all global energy supply. The International Energy Agency's IEA's *2015 World Energy Outlook* forecasts that by 2040, fossil fuels will still provide 75% to 70% of the world's energy. Developing and emerging countries are moving ahead rapidly with electrification of their economies, and it appears that, despite the Paris climate change deal agreed to at the end of 2015, coal will continue to play central role. Indeed, data from Platts World Electric Power Plants Database shows that nearly 1.2 terawatts of new coal-fired power plants are under construction or in the planning phase, accounting for nearly 40% of the total generating capacity of all generating technologies now under construction or planned (see Figure H-4). China and India alone account for 70% of the total coal capacity under construction or planned, and Asia about 89%. The capacity of natural gas- and oil-fired power stations also is expected to grow considerably over the next few years, by about 565 billion and 50 billion watts, respectively.

Improvements in energy intensity, which can help moderate other energy security risks, are something of a mixed bag. Energy intensity measures the amount of energy needed to produce a unit of GDP and can be improved both through greater energy efficiency and relative shifts in economic activity from more to less energy intensive activities (e.g., from industrial to service activities). Although of the developed countries in the large energy user group continue to see declines, often very large declines, in energy intensity, the economies in transition and the emerging economies show greater variation. Looking at the trends for the last five years, those countries with lower GDP per capita tend to show the smallest decreases, if not actual increases, in energy intensity while the more economically advanced countries tend to show the largest decreases (though usually not as large as for developed economies). This is consistent with observed patterns among over much longer periods of time. As incomes rise, so do the resources available for investment in new, more efficient technologies and a shift to less energy-intensive economic activity. The result is that energy intensity tends to rise as countries develop, peak, and then decline. A similar pattern is seen in carbon dioxide emissions intensity. Data measuring per capita GDP and carbon dioxide emissions per unit of GDP show that poor that emissions intensity is higher in middle income countries than in either poor or wealthy countries. As countries move from middle income to high income, we can expect that their energy and emissions intensities will begin to improve decline more rapidly.

Historical Trends in International Energy Security Risks: 1980-2014

Energy security risk scores for the large energy user group countries show a variety of trends over the years. On average, however, the rise in total energy security risk scores for this group of countries since

about the early 2000s stabilized in the late 2000s and declined sharply after 2010. From the beginning of our database in 1980, the average country in the large energy user group saw its total risks decline through the 1980s, level out in the 1990s, rise in the 2000s, and decline in the 2010s (Figure H-5). The overall decline in risk since 2011 has been driven primarily by a decline in the price volatility of crude oil, but as was mentioned earlier, this risk metric is expected to move higher in the next couple of years because of the sharp drop in crude oil prices that began in 2014 and continued on into 2015 and through the early part of 2016. Whether the expected rise in volatility will be enough to send total risk scores higher remains to be seen. Ongoing long-term improvements in energy use metrics, such as energy intensity and petroleum intensity, will continue to put downward pressure on risks in many countries. If these and other trends can be maintained, and if the unconventional oil and gas revolution can be replicated in other countries, the steep drop in overall risk measured over the last couple of years could carry on well into the future.

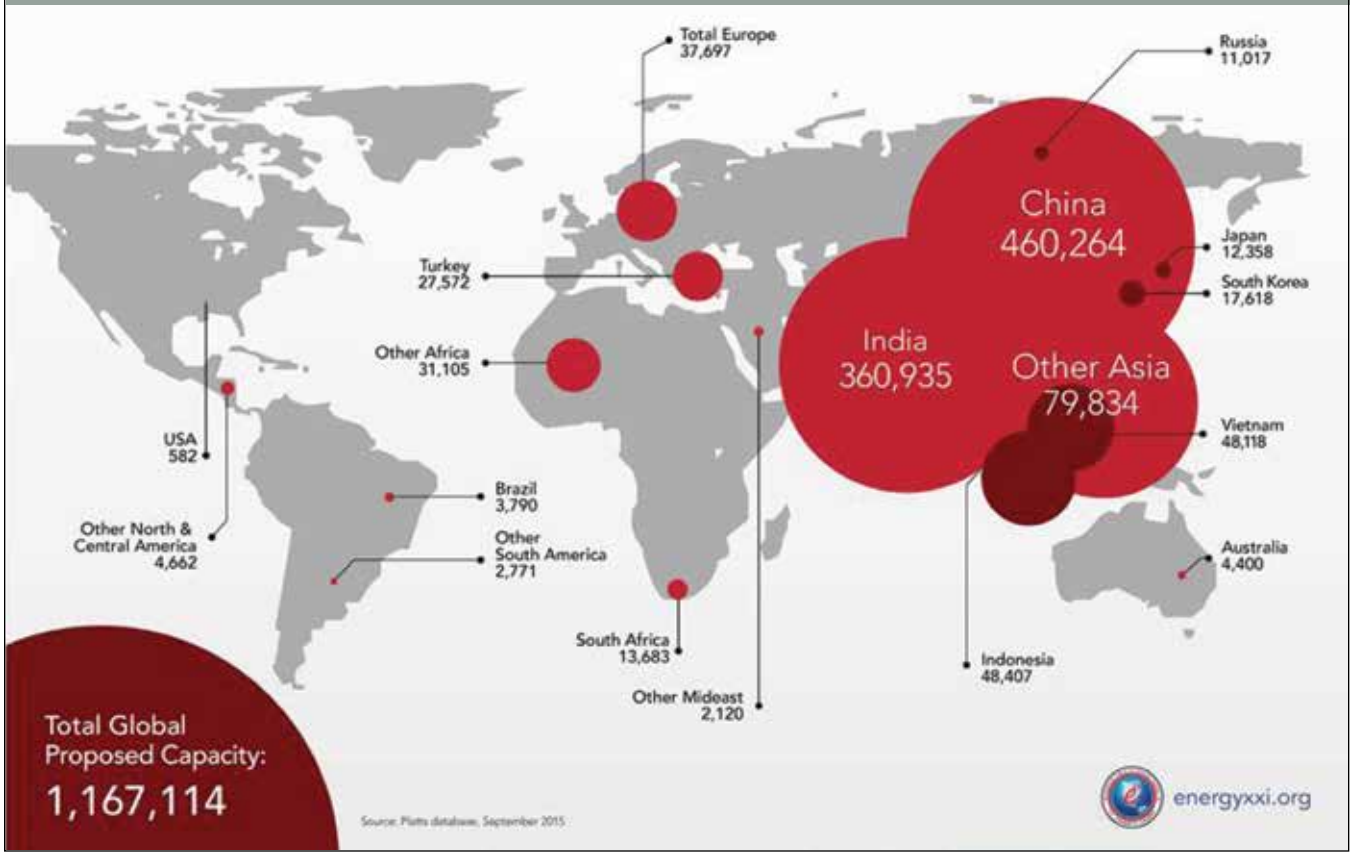
The improvement in overall energy security risk in 2014 was, with but a few inconsequential exceptions, the third consecutive year of declining risks for most countries in the large energy user group. All 25 countries have a lower overall risk in 2014 compared to 2011. Of the 23 countries in the large energy user group in existence since 1980, all but seven have lower total energy security risks in 2014 than they did in 1980, a year of extraordinarily high risk.[2] Of the seven countries with higher risks in 2014 than in 1980, all but one (Australia) are emerging economies.

The decade of the 1990s was the best for energy security risks. Of the 23 countries in the large energy

2 Excludes the Russian Federation and Ukraine, for which data begin in 1992. The 2013 total risk score for each country is lower that its 1992 score.

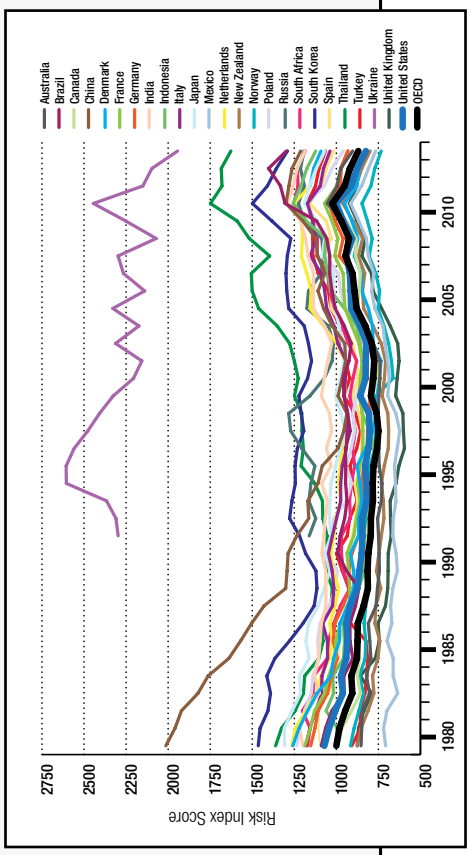
Figure H-4. Coal-Fired Power Plants Planned and Under Construction

Total installed capacity (megawatts)



Source: Platts World Electric Power Plants Database.

Figure H-5. Energy Security Risk Index Scores for Large Energy User Group: 1980-2014



user group in existence in 1980, 12 of them (mostly economically advanced) had their best risk score somewhere between 1990 and 1999. Given the high share of oil in the energy mix of developed countries, this is hardly surprising considering the large drop in oil-related risks during the 1990s. For the United States, it was 1998,[3] as it was for the OECD average. The best scores for the three former Soviet Bloc countries come after 2002, reflecting vastly better energy use risk scores over time as these economies become more efficient (though they still have a long way to go before they see scores near the OECD average).

Rapid moves up or down the large energy group ranking are uncommon, but when a number of factors are aligned within a country, rapid movements do occur and can be sustained over a long period. Trends in country rankings tend to be driven by four types of factors: (1) global factors that affect all countries and which are largely immune to policy responses; (2) country-specific factors such as resource base, stage of

3 The 2014 edition of the Index of U.S. Energy Security Risk has 1992 as the year with the lowest risk score. The difference stems from the fact that data limitations require the use of a different, smaller set of metrics for the International Index.

Table H-3. Energy Security Rankings for Large Energy User Group: 1980-2014

	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014
Australia	2	4	3	3	4	8	8	9	9	10	8
Brazil	10	8	13	16	17	13	13	22	22	23	23
Canada	7	7	5	5	7	6	6	7	7	7	7
China	23	23	23	21	19	19	20	21	21	21	21
Denmark	18	14	9	10	5	4	5	4	3	4	5
France	15	13	12	11	11	11	10	10	10	9	10
Germany	12	12	11	9	8	7	9	8	8	8	9
India	16	19	21	20	21	20	22	20	20	20	19
Indonesia	8	10	7	6	9	12	17	19	18	17	17
Italy	14	16	18	17	16	18	15	12	13	13	13
Japan	20	21	19	19	20	15	12	15	16	15	15
Mexico	1	1	1	2	2	3	2	2	2	2	2
Netherlands	19	15	17	18	15	21	21	17	15	16	16
New Zealand	4	2	4	4	3	5	4	5	5	3	3
Norway	6	6	6	7	6	2	1	1	1	1	1
Poland	17	20	16	14	12	10	14	13	11	11	11
Russia	–	–	–	23	22	22	19	16	17	18	20
South Africa	13	17	14	15	14	14	18	18	19	19	18
South Korea	22	22	22	24	23	23	23	23	23	22	22
Spain	11	11	10	12	13	16	11	11	12	12	12
Thailand	21	18	20	22	24	24	24	24	24	24	24
Turkey	5	5	15	13	18	17	16	14	14	14	14
Ukraine	–	–	–	25	25	25	25	25	25	25	25
United Kingdom	3	3	2	1	1	1	3	3	4	5	6
United States	9	9	8	8	10	9	7	6	6	6	4

economic development, population density, climate, and others; (3) technology innovation and adoption; and (4) energy policies. Table H-3 ranks energy security risks over time. Although large annual movements, either up or down, in the ranking list are uncommon, the interplay among many different factors, such as technology developments, political crises, natural disasters, policy changes, or combinations of these, can result in unusually large changes annual in rank among the large energy user group. As the table shows, Canada, Mexico, New Zealand, South Korea, and Ukraine have shown the least variation in total risk ranking for the entire period since 1980 (or in the case of Ukraine, 1992). Some countries, on the other hand, have shown a great deal of variation in ranking over the years.

- Since 2011, Brazil has seen its risk scores deteriorate greatly relative to the OECD average, especially in metric scores related to energy expenditures and energy expenditure intensity. Brazil also has seen a large increase in import and transportation related risks. Brazil has slipped 10 places, from number 13 in 2010 to number 23 in 2014.
- Demark moved sharply up the table between 1985 and 1990, when it became a net exporter of natural gas, and again between 1995 and 2000, when it became a net exporter of oil. It now stands at number five in the ranking.
- Natural disasters and their aftermath also can impact energy security in often unpredictable ways. In the case of the Fukushima Daiichi incident in Japan, for example, it reversed previous gains in risk reduction.
- Poland has improved to ranking significantly since the breakup of the Soviet Union. Greater energy efficiency made necessary by market forces and a lowering of risk surrounding coal exports have made Poland far more energy secure, but it still has considerable room for further improvement.
- Turkey's risk score increased 151 points from 1985 to 1990 caused by rising risks associated with greater imports of natural gas needed to supply new gas-fired power stations. As a result, the country's risk ranking worsened from fifth in 1985 to 15th in 1990, showing how a clear policy choice can lead to significant energy security consequences.
- The United Kingdom also has seen its position tumble from the top spot in 2005 to number six in 2014. Greater risks associated with rising imports and very high electricity prices have been the main reasons for the United Kingdom's downward slide.
- The relatively recent ascent of the United States up the rankings is a good example of how technology innovation and adoption, in this case of hydraulic fracturing, horizontal drilling, and advanced seismic imaging, have changed energy security for the better despite, rather than because of, federal policies.

No country scores well in every energy risk category or scores poorly in every category. Countries that score very well in the Index also can face sometimes significant energy security challenges. Of the 29 metrics used in the International Index, nine are "universal" metrics that apply equally to every country (e.g., the price of crude oil) and 20 are "country-specific." Scores for these 20 country-specific metrics for 2014 were ranked (Table H-4). The table shows than even a country the top-ranked country, Norway, with 11 of 20 metric scores ranked in the top five, also has three metric scores ranked in the bottom five (two of which are ranked dead last—energy consumption per capita and electricity capacity diversity). But as you would expect, countries that score well tend strongly to have more metrics in the top five than in the bottom five. Last-ranked Ukraine, for instance, has eight metrics in the bottom five and just two in the top five.

On average, the five top ranking countries in 2014 for overall energy security have 7.8 individual metrics scores ranked in the top five and 1.2 metrics scores ranked in the bottom five. (Fourth-ranked United States had four metric scores ranked in the top five and three scores ranked in the bottom five.) The five countries with the worst overall scores in 2014 had an average of only 1.6 metric scores ranked in the top five and 6.4 metric scores ranked in the bottom five. For many countries that score well, reversing or offsetting negative trends while maintaining positive trends is the order of the day. The other 15 countries in the middle averaged 4.1 metric risk scores both in the top five and bottom five. (The number of metrics in the top and bottom five for each country can be found in the Energy Security Profiles.)

Table H-4. Energy Security Metric Rankings for Large Energy User Group: 2014

Fuel Import Metrics				
Petroleum Import Exposure	**Natural Gas Import Exposure**	**Coal Import Exposure**	**Total Energy Import Exposure**	**Fossil Fuel Import Expenditures per GDP**
1. Canada	1. Australia	1. Australia	1. Canada	1. Canada
1. Denmark	1. Canada	1. Canada	1. Russia	1. Russia
1. Mexico	1. Denmark	1. China	3. Norway	3. Norway
1. Norway	1. Indonesia	1. Indonesia	4. China	4. Denmark
1. Russia	1. Netherlands	1. New Zealand	5. Mexico	5. Mexico
6. Brazil	1. New Zealand	1. Poland	6. Denmark	6. United Kingdom
7. United States	1. Norway	1. Russia	7. Brazil	7. United States
8. United Kingdom	1. Russia	1. South Africa	8. South Africa	8. Brazil
9. Indonesia	9. United States	1. Ukraine	9. United States	9. Australia
10. Thailand	10. Thailand	1. United States	10. Australia	10. New Zealand
11. China	11. China	11. Norway	11. Indonesia	11. France
12. Australia	12. India	12. India	12. India	12. Germany
13. South Africa	13. Mexico	13. Mexico	13. Ukraine	13. Italy
14. New Zealand	14. Brazil	14. Germany	14. New Zealand	14. China
15. India	15. United Kingdom	15. Turkey	15. Thailand	15. Japan
16. Ukraine	16. Ukraine	16. Thailand	16. Poland	16. Spain
17. Italy	17. Poland	17. United Kingdom	17. United Kingdom	17. Poland
18. Turkey	18. South Africa	18. Spain	18. France	18. South Africa
19. Germany	19. Germany	19. Brazil	19. Netherlands	19. Netherlands
20. Poland	20. Italy	20. South Korea	20. Germany	20. Indonesia
21. Netherlands	21. Japan	21. Italy	21. Spain	21. Turkey
22. France	22. Turkey	22. Denmark	22. Italy	22. India
23. South Korea	23. Korea, South	22. France	23. Turkey	23. South Korea
24. Spain	24. France	22. Japan	24. South Korea	24. Thailand
25. Japan	25. Spain	22. Netherlands	25. Japan	25. Ukraine

Table H-4. Energy Security Metric Rankings for Large Energy User Group: 2014

Energy Expenditure Metrics			Price & Market Volatility Metrics	
Energy Expenditure Intensity	**Energy Expenditures Per Capita**	**Retail Electricity Prices**	**Energy Expenditure Volatility**	**GDP Per Capita**
1. United Kingdom	1. India	1. Indonesia	1. Mexico	1. Norway
2. France	2. Indonesia	2. India	2. New Zealand	2. Denmark
3. Norway	3. Mexico	3. China	3. Norway	3. United States
4. United States	4. China	4. South Africa	4. Canada	4. Netherlands
5. Denmark	5. South Africa	5. United States	5. United Kingdom	5. Germany
6. Germany	6. Ukraine	6. Canada	6. United States	6. United Kingdom
7. Spain	7. Turkey	7. South Korea	7. France	7. Canada
8. Japan	8. Poland	8. Mexico	8. Germany	8. Australia
9. New Zealand	9. Thailand	9. Thailand	9. Netherlands	9. Japan
10. Italy	10. Russia	10. Norway	10. Spain	10. France
11. Mexico	11. Spain	11. Australia	11. Italy	11. New Zealand
12. Australia	12. Brazil	12. New Zealand	12. Denmark	12. Italy
13. Canada	13. France	13. Russia	13. Turkey	13. Spain
14. Poland	14. United Kingdom	13. Ukraine	14. Japan	14. South Korea
15. Netherlands	15. Italy	15. Poland	15. South Korea	15. Poland
16. Turkey	16. New Zealand	16. France	16. Australia	16. Turkey
17. India	17. Germany	17. Turkey	17. India	17. Mexico
18. South Korea	18. Japan	18. United Kingdom	18. China	18. Russia
19. South Africa	19. United States	19. Netherlands	19. Poland	19. South Africa
20. Russia	20. Denmark	20. Brazil	20. South Africa	20. Brazil
21. China	21. Australia	21. Japan	21. Indonesia	21. China
22. Indonesia	22. Canada	22. Spain	22. Russia	22. Thailand
23. Brazil	23. South Korea	23. Denmark	23. Thailand	23. Ukraine
24. Thailand	24. Norway	24. Germany	24. Ukraine	24. Indonesia
25. Ukraine	25. Netherlands	25. Italy	25. Brazil	25. India

Table H-4. Energy Security Metric Rankings for Large Energy User Group: 2014

Energy Use Intensity Metrics			Electric Power Sector Metrics	
Energy Consumption Per Capita	**Energy Intensity**	**Petroleum Intensity**	**Electricity Capacity Diversity**	**Non Carbon Generation**
1. India	1. Denmark	1. Denmark	1. Spain	1. Norway
2. Indonesia	2. United Kingdom	2. United Kingdom	2. Italy	2. France
3. Mexico	3. Italy	3. Norway	3. New Zealand	3. Brazil
4. Turkey	4. Japan	4. Italy	4. Germany	4. Canada
5. Brazil	5. Germany	5. France	5. Japan	5. New Zealand
6. Thailand	6. France	6. Germany	6. United Kingdom	6. Ukraine
7. China	7. Spain	7. Japan	7. Canada	7. Spain
8. Poland	8. Norway	8. Spain	8. Turkey	8. Denmark
9. Italy	9. Netherlands	9. Turkey	9. United States	9. Germany
10. Spain	10. New Zealand	10. New Zealand	10. Russia	10. United Kingdom
11. South Africa	11. United States	11. Poland	11. South Korea	11. Russia
12. United Kingdom	12. Mexico	12. United States	12. France	12. United States
13. Denmark	13. Turkey	13. Australia	13. Ukraine	13. Italy
14. Ukraine	14. Australia	14. Netherlands	14. Brazil	14. South Korea
15. Japan	15. Poland	15. Canada	15. Denmark	15. Mexico
16. France	16. South Korea	16. South Africa	16. India	16. Turkey
17. Germany	17. Canada	17. South Korea	17. Mexico	17. Australia
18. New Zealand	18. Brazil	18. Mexico	18. Netherlands	18. India
19. South Korea	19. Indonesia	19. China	19. Indonesia	19. Netherlands
20. Netherlands	20. India	20. India	20. Australia	20. Thailand
21. Russia	21. South Africa	21. Brazil	21. China	21. Indonesia
22. Australia	22. Thailand	22. Ukraine	22. Thailand	22. South Africa
23. United States	23. China	23. Russia	23. Poland	23. China
24. Canada	24. Russia	24. Indonesia	24. South Africa	24. Poland
25. Norway	25. Ukraine	25. Thailand	25. Norway	25. Japan

Table H-4. Energy Security Metric Rankings for Large Energy User Group: 2014

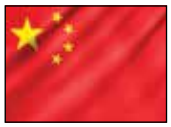
Transportation Sector Metrics		Environmental Metrics		
Transport Energy Per Capita	**Transport Energy Intensity**	**CO_2 Emissions**	**CO_2 Per Capita**	**CO_2 GDP Intensity**
1. India	1. Norway	1. Germany	1. India	1. Norway
2. Indonesia	2. Germany	2. Poland	2. Indonesia	2. France
3. China	3. Japan	3. Denmark	3. Brazil	3. Denmark
4. Turkey	4. United Kingdom	4. France	4. Mexico	4. United Kingdom
5. Ukraine	5. France	5. United Kingdom	5. Turkey	5. Italy
6. Thailand	6. Denmark	6. Italy	6. Thailand	6. Germany
7. Mexico	7. Turkey	7. United States	7. France	7. Japan
8. Poland	8. Italy	8. Russia	8. Italy	8. Spain
9. South Africa	9. Netherlands	8. Ukraine	9. Spain	9. New Zealand
10. Brazil	10. South Korea	10. Canada	10. United Kingdom	10. Netherlands
11. South Korea	11. Australia	11. Japan	11. Poland	11. United States
12. Japan	12. Spain	12. Netherlands	12. Denmark	12. Canada
13. France	13. New Zealand	13. Norway	13. New Zealand	13. Mexico
14. Germany	14. United States	14. Spain	14. China	14. Australia
15. United Kingdom	15. Poland	15. New Zealand	15. Ukraine	15. Turkey
16. Italy	16. Canada	16. Mexico	16. Norway	16. South Korea
17. Russia	17. India	17. Australia	17. Japan	17. Brazil
18. Spain	18. China	18. South Africa	18. Germany	18. Poland
19. Denmark	19. Mexico	19. Brazil	19. South Africa	19. Indonesia
20. Norway	20. Indonesia	20. Turkey	20. South Korea	20. Thailand
21. Netherlands	21. South Africa	21. South Korea	21. Netherlands	21. India
22. Australia	22. Russia	22. Indonesia	22. Canada	22. South Africa
23. New Zealand	23. Brazil	23. India	23. Russia	23. China
24. Canada	24. Thailand	24. China	24. Australia	24. Russia
25. United States	25. Ukraine	25. Thailand	25. United States	25. Ukraine

Large Energy User Group Country Summaries

Australia: Australia consistently has ranked in the top 10 of the large energy user group, at one time as high as number two. In 2014, the country's score of 903 earned it an eighth place ranking, up two places from the previous year. Australia is a large net exporter of coal and natural gas and a net import of petroleum. It is the world's second largest exporter of coal and third largest exporter of liquefied natural gas. Coal and natural gas are the main fuels used to generate electricity. A prohibition on nuclear power means it plays no role at all, despite Australia possessing large uranium resources. Because low-cost coal is the dominant fuel used in power production, Australia enjoys comparatively low electricity prices. Australia's economy is relatively energy intensive, however, and its energy use risk scores trend higher than the comparable OECD scores. The country also is a relatively large emitter of carbon dioxide. In 1980, Australia's total risk score was 15% below the OECD average. In 2014 it was about 4% higher, meaning that, from a strong position in 1980, its energy security over the years has worsened markedly vis-à-vis the OECD average.

Brazil: Brazil's energy security risk score of 1,297 showed some improvement in 2014, but it is still nearly half again as high as the OECD average. Brazil is in the top 10 countries both for energy consumption (10th) and production (eighth). Brazil is a net exporter of crude oil, but imports large amounts of natural gas and coal. The country's large sugar cane-based ethanol industry has contributed to reducing oil demand and making more oil available for export. Brazil also boasts offshore "pre-salt" basin oil deposits that could hold as much as 50 billion barrels of oil. Virtually all of Brazil's population now has access to at least some electricity. Brazil's electricity generating sector is dominated by hydropower, which accounts for about four-fifths of total electricity production. Concerning energy use, although Brazilians tend to use less energy per person than people in other OECD countries, they also tend to use that energy far less efficiently, a common situation for an emerging economy.

Canada: Canada's energy security risk scores have tracked closely to the OECD average, barely venturing further than 5% above or below it. In 2014 score of 832 was good enough for seventh position, the same as in 2013. Canada has extensive hydrocarbon resources and is a large energy producer and exporter. It is no surprise that Canada scores very well in those metrics measuring oil, natural gas, and coal import exposure risks. Most all of the oil and natural gas what Canada exports to the United States is via pipeline, but Canada also is working to diversify its export markets, especially for crude oil. Canada's power sector is diverse compared to other countries in the large energy user group. It is among the world's largest producers of hydroelectric power, which accounts for about 60% of its electricity generation. The country's electricity prices compare very favorably against the OECD average and rank sixth in the large energy user group. Canada would score higher overall except for its relatively poor scores in energy intensity and energy use per capita, especially in the transportation sector. Canada is a large country with a cold climate, a relatively low population density, and a lot of mining and other energy intensive activity. It is not surprising, therefore, that Canada's energy use per capita and transport energy use per capita scores are very high. Except for emissions per capita, which is high, Canada's carbon dioxide-related measures score at about the OECD average.



China: After years of steady progress, both absolutely and relative to the OECD average, China's risk scores since 2008 have stalled, and its position relative to the OECD average has worsened. In 2014, its risk score was ranked 21. China's energy resources are among the largest in the world. The Congressional Research Service estimates that with 475 billion barrels of oil equivalent—more than 90% of which is coal—China has the third highest fossil fuel reserves

of any country in the world.[4] Nevertheless, China's domestic energy production has not been able to keep pace with demand, and it imports a growing portion of the oil, natural gas, and coal it uses (even as it produces more coal than any other country). China's electricity generating sector is one of the least diverse in the large energy user group, with a 2014 rank of 21, but its reliance on coal also means its average electricity price is among the lowest in the group. China's energy intensity has improved steadily, but it is still well above the OECD average. China's transport energy intensity, on the other hand, has worsened relative to the OECD average, a trend that is expected to continue. Even in its per capita energy use and emissions measures, where China presently scores considerably better than the OECD average, the trends are moving in the direction of greater risk.

Demark: In 2014, Denmark slipped one place to number five in our ranking with a score of 827. This is the first time Denmark has bested the OECD average. Denmark scores very well in a number metrics measuring imports, energy use, and emission risks. Denmark is a net exporter of oil and natural gas, but must import all of its coal. The country is one of the most energy efficient in the world, and its energy intensity in 2010 was the best among the group. In fact, of the 20 country-specific metrics, it scores in the top five for nine of them—only Norway has more in the top five. Denmark's power sector diversity is not all that different from the OECD average, with generation being about evenly divided between coal and renewables, and a significant and growing amount of natural gas. The shift towards more expensive renewable sources of energy, however, means retail electricity prices in Denmark are very high, third highest in the large energy user group. Moderating the risks from increasing energy prices is the fact that the country has one of the most energy efficient economies in the world. Denmark's carbon dioxide emission trends generally slightly better than the OECD average.

France: Ranked number 10, France's energy security 2014 score of 932 was about 7% above the OECD average, a vast improvement from the earlier scores that approached 20% more than the above. With the second largest economy in Europe, France is a large consumer of energy. It produces very little crude oil and natural gas domestically, and no coal. It must, therefore, rely on imports for much of its energy supply, and import risks are therefore a big factor influencing France's energy security risk scores. France displays a relatively high degree of energy efficiency that helps moderate these risks, and its strategic decision to make nuclear power a substantial part of its energy mix has helped France lower its fossil fuel imports. Though France's electricity rates are high when compared against those in the entire large energy user group, they are second lowest (to Norway) among the seven Western European countries within that group. Its transport energy intensity score is particularly good compared to its peers. Its three carbon dioxide emission metrics also are quite good, with its carbon dioxide intensity metric ranked second in the large energy user group.

Germany: From reunification to 2000, Germany's energy security risk scores improved consistently, both absolutely and relative to the OECD average.[5] Since about 2007, however, Germany's scores have not kept pace with the OECD average, and it ranking has stumbled from number seven to a still respectable nine in 2014. Energy costs are very high, and Germany's electricity prices—second highest in the large energy user group—have grown at a much faster rate than the OECD average, which explains some of the lost ground against its OECD peers. Another reason is that Germany is Europe's top consumer of petroleum, natural gas, and coal and relies on imports to meet most of its needs for these fuels. It is Europe's top consumer of all of these fuels and relies on imports to meet most of its needs for these fuels. In the power sector, coal remains the lowest-cost generating option in Germany, and presently coal plants account for nearly half of the country's power generation. New coal stations are being planned or built to replace some of the lost nuclear generating capacity resulting from

4 Congressional Research Service. 2011. *U.S. Fossil Fuel Resources: Terminology, Reporting, and Summary*. CRS Report for Congress R40872.

5 For consistency, East German data and West German data have been combined to yield "German" data from 1980 to 1990. These data should not be considered as reliable as the data after 1990.

the government mandate to close Germany's nuclear facilities by 2022. Germany is among the most efficient in the large energy user group. It uses less energy per person and dollar of GDP than most other countries in the group, especially in the transport sector, where Germany ranks number two. Its emissions score is the best (lowest) in the group.

India: India's overall energy security risk ranked number 19 in 2014. India is the world's fourth largest energy consumer, and it depends on imports to meet much of its demand. Hundreds of millions of Indians lack access to electricity. Coal is the dominant fuel in the electricity sector, and since 1980, India has added about 90 gigawatts of thermal generating capacity, most of which was coal-fired. Even though India has the fifth largest coals reserves in the world, imports of that fuel have been increasing steadily for many years. The country has set a goal of doubling coal production by 2020. Like many emerging economies, India's economy is relatively inefficient in its energy use. As a result, its economy-wide and transportation energy intensity metrics compare unfavorably with the OECD average. India also is a major emitter of carbon dioxide, but by virtue of its large population rather than its per capita emissions. In the large energy user group, all of India's energy and emissions per capita metrics are ranked number one. As India approaches middle income status, it is expected that the risk scores for these metrics will increase.

Indonesia: With a 2014 ranking of 17, Indonesia is an example (like Russia) of a country with large domestic energy resources but a relatively poor energy security risk scores. Its 2014 overall risk score of 1,123 exceeded its 1980 score by 29%. Indonesia produces large amounts of oil, natural gas, and, especially, coal. It is a large exporter of natural gas and coal, but since 2004 it has had to import oil to meet demand. Energy policy is now focused on meeting national energy demand rather than exports (although in late 2015 Indonesia announced it was going to rejoin OPEC). Electrification of the country is a top priority of the government, which has set a goal of providing power to 90% of the population by 2020 from about 75% today. Its electricity prices are very low. The Indonesian economy is not very efficient, and the amount of energy used to produce a unit of GDP in Indonesia is higher now than it was in 1980. Like many other emerging economies, risks scores for transportation metrics have been trending higher. Emissions also are trending higher, again consistent with Indonesia's economic progress.

Italy: Italy's overall energy security risk has consistently been quite a bit higher than the OECD average, typically ranging from 15% to 30% above. At more than 1,038, its overall risk score is one of the highest among the developed countries in the large energy user group and ranks 13th. Italy relies largely on imports to fuel its economy. Over the last decade, Italy's natural gas production has been declining, increasing the country's reliance upon gas imports, most of which arrive through pipelines and is supplied from Algeria and Russia. Italy has a diverse power sector. Since the mid-1990s, Italy has been moving away from oil—which once supplied over half the country's electricity output—towards natural gas, which is now the most widely used fuel for producing electricity. Natural gas prices in Italy, however, are extraordinarily high. Because of its reliance on expensive natural gas and its increased use of renewables for electricity generation, Italy's electricity prices are the highest in the large energy user group. Italy uses energy efficiently, and both its energy intensity and petroleum intensity measures are ranked in the top five.

Japan: With no domestic fossil energy resources to speak of, Japan has one of the highest energy security risk scores of any of the developed countries in the large energy users group. In 2013, it was ranked 23 with a score of 1,068. From the mid-1990s to 2010, Japan made considerable progress in closing the energy security risk disparity with its peers in the large energy user group. Some of that progress, however, was undone after the Fukushima Daiichi incident in 2011, which led to the closing of its nuclear facilities. Japan is among the world's biggest importers of oil, liquefied natural gas, and coal. Its import exposure risks for all of these commodities are well above the OECD average, as are its import expenditures as a

share of GDP. Japan's decision to close its nuclear plants increased the demand for imported fuel, exacerbating these risks. Japan scores in the bottom five for each of the energy import metrics. Today, only two of Japan's 43 operable nuclear plants are operating, and it is unclear how many of the remaining plants will be brought back on line, but it is likely to be fewer than half. To make up for this lost capacity, Japan has more than 40 coal-fired power plants in the works. A saving grace for Japan is its high level of energy efficiency, which acts to moderate some of the unavoidable risks of importing so much energy. Japan's scores in metrics measuring energy intensity both economy-wide and in the transport sector are in the top five of the large energy user group. Moreover, its per capita energy use scores are better than the corresponding scores for its OECD peers.

Mexico: Since 1980, Mexico's energy security ranked as the first, second, or third most secure country in the large energy user group. It ranks consistently high (number two in 2014) by virtue of its comparatively good scores in metrics measuring fossil fuel imports, energy expenditure, and per capita energy use scores. es. Mexico's energy security risks, however, are losing ground to the OECD average. As a result, Mexico's advantages are shrinking: From a 1980 score 29% better than the OECD average, its score in 2014 was just 12% better. Mexico has a large domestic energy sector focused primarily on oil. Oil production levels are declining, however, and imports of natural gas have increased to meet domestic demand. Coal imports also are needed. To combat declining oil production, the Mexican government instituted constitutional reforms to open up its hydrocarbon sector to outside companies. Mexico has a potentially large shale gas resource, which at 545 trillion cubic feet is about 30 times proved reserves. The constitutional reforms were passed in part by a desire to bring into the country the expertise needed to tap these resources. Mexico's energy use metrics are generally better than the OECD average. While the amount of energy or emissions each person uses or emits is less than the OECD average, these metrics are moving in a riskier direction. Mexico also scores comparatively worse than its peers in those aspects related to energy intensity and emissions intensity. As Mexico continues to grow and develop and its middle class expands, these metrics should begin to move closer to the OECD average.

Netherlands: At number 16, the Netherlands is the least energy secure of all the developed countries in the large energy user group, a distinction for which it has been vying with Italy. Since 1980, its scores have largely in tandem with the OECD, if about 18% higher. The Netherlands has a very large oil and gas sector for a country of its size, and the city of Rotterdam plays a key role as a processing, storage, and distribution center for the rest of Europe. It produces very little crude oil of its own and therefore imports large volumes of this product. It is, however, among the world's largest net exporters of refined petroleum. The Netherlands produces large amounts of natural gas. About half of the Netherland's electricity generation capacity is gas-fired. With such a heavy concentration of natural gas facilities, it is not surprising that its retail electricity prices are quite a bit higher than the OECD average. The Netherlands relatively high energy use risk scores reflect the country's unusually large oil and gas sector.

New Zealand: New Zealand's energy security risk ranking has never, since 1980, fallen below fourth and was third in 2014. Since 1990, the country's scores have moved within a range of 5% to 10% below the OECD average. New Zealand produces all of the natural gas and coal it uses. Therefore, its import risk scores for these two fuels are much better than the OECD average, and the risk score for oil is not appreciably different from the OECD average. New Zealand has one of the most diverse power sectors in the large energy user group, with hydroelectric power, natural gas, renewables, and coal all having a significant share of total capacity. New Zealand has benefited from relatively low electricity rates in the past, but recently these have approached the OECD average. New Zealand also uses a bit more energy, both overall and in the transport sector, to generate a dollar's worth of GDP than the baseline of OECD countries. Its carbon dioxide emissions trend is also somewhat worse than the OECD average, but its emissions intensity and emissions per capita generally track OECD.

Norway: Norway has been ranked number one since 2006. From 2000 to 2001, Norway's energy security ranking rose from five to two—a shift related largely to the country becoming a net coal exporter. Since then, Norway's scores have stayed a steady 15% or so below the OECD average. It has the largest number of individual metrics in the top five of any country in the large energy user group—11. Norway scores very well in the fuel import measures compared to the OECD baseline, and it is a reliable supplier of fossil fuels to regional and global markets. Norway's electricity sector is the least diverse in the group, with more than 95% of its generation coming from hydroelectric facilities, and its electricity rates are a bit better than the OECD average. Risk scores for per capita energy expenditures and per capita energy use also are well higher (worse) than the OECD average, not unusual for a small country which has such a large oil and gas industry (similar to the Netherlands). The country's very high rankings in the imports, expenditure and energy intensity, transportation, and emissions risk categories, however, have been more than enough to offset these areas of high risk and propel Norway to the top spot.

Poland: Of the three former Soviet Bloc countries, Poland has displayed the lowest energy security risk for most of the period from 1980 to 2014. When set against the OECD average, Poland's energy security risk has shown uneven improvement, moving up the rankings from number 17 in 1980 to number 11 in 2014. Poland has a large coal resource that provides more than half of the energy used. Most of that coal consumption is for electricity generation--between 80% and 90% of its electric power is produced at coal-fired power stations--though large volumes also are used in industry. Poland must import most of the oil and natural gas it uses, primarily from Russia. A potentially large shale gas resource so far has yielded disappointing test drilling results. Polish energy demand is expected to increase as its economy grows and develops. Its energy use measures are higher than the OECD average, typical for a country undergoing a transition to a market-based economy. Poland's carbon dioxide emissions are still comparatively better than the OECD baseline, though its carbon dioxide emissions intensity is high by OECD standards. Its reliance on secure sources of domestic coal has created tensions within the European Union over its climate policy.

Russian Federation: Russia's extraordinarily large energy resources are not reflected in its energy security risk ranking over the years. In 2014, it had a total risk score of 1,192. With all of its resources, one would expect Russia to be better positioned than its 2014 ranking of 20 indicates. Russia is one of the world's largest producers of crude oil, natural gas, and coal. Russia exports large volumes of fossil fuel, but it has on occasion shown to use its energy clout in the service of achieving geopolitical ends. After decades of communist rule, however, Russia's economy remains relatively inefficient. Russia scores very poorly in metrics measuring energy use, transportation, and emissions, which account for Russia's surprisingly poor showing in the large energy user group rankings.

South Africa: A 2014 score of 1,185 places South Africa's in 18th place in the ranking. It is the wealthiest country in Africa and is rich in coal. The country also has the world's only commercial coal-to-liquids facility that produces a substantial portion of South Africa's demand for liquid fuels. EIA estimates that South Africa may have 390 trillion cubic feet of technically recoverable shale gas (but apparently no shale oil), a substantial potential resource that if developed could lower the risks inherent in relying on imported natural gas. About 75% of the population has access to electricity. Coal dominates the power sector, accounting for about 95% of generation. Trends over the past few years suggest that the energy security gap between it and the OECD average is widening. The country's scores for individual measures of risk exhibit many of the drawbacks one would expect to see in a large emerging economy with a growing middle class. Like most of the emerging economies, South Africa uses energy less efficiently than the OECD average, and its carbon dioxide emissions are increasing rapidly.

South Korea: South Korea consistently has had very high energy security risk scores of between 45% and 60% more than the comparable OECD

baseline scores. It has never had a higher ranking than 22nd. With few domestic energy resources, this highly-industrialized country is one of the world's biggest energy importers, importing large volumes of oil, natural gas, and coal. Given its high level of imports, Korea's score for average retail electricity rate is unexpectedly low. The extensive use of coal and nuclear power generation, however, has helped offset growing generation from high-priced natural gas. South Korea's intensity measures—covering total energy, petroleum, and emissions—are all higher than their OECD averages, a situation that is not likely to change soon. Indeed, the trends for these metrics since 1980 indicate in some cases a worsening, relative to their OECD averages. Korea does score comparatively well, however, in transportation energy use. As Korea continues to develop, we should see the risk scores for these metrics begin to lower and Korea move up the large energy user group ranking.

Spain: Like South Korea, Spain is a large importer of oil, natural gas, and coal. The reason Spain in 2014 is ranked number 12 rather than closer to South Korea is because it uses energy much more efficiently. Spain produces almost no oil or natural gas and little coal, so it must import these fuels to meet domestic demand. As a result of its large imports, its fossil fuel import risks are comparatively large (its rankings for oil, natural gas, and total import risks are in the bottom five). Spain has the most diverse power sector of any country in the large energy user group, but its electricity prices are very high (top five). Spain scores relatively well in the energy use risk categories. It has a smaller energy intensity score than the OECD average, and this has helped moderate the impact of rising imports and energy costs. These energy intensity metrics, along with Spain's emissions metrics, are not improving at the same rate as the OECD average, however.

Thailand: In 2014, Thailand's energy security risk score was the second worst in the large energy user group, a position it has held since 2000. Its score of 1,626 is much higher than its 1980 score of 1361, which means that Thailand's risk scores have worsened both in real terms and in comparison to the OECD average. It is the only country without at least one individual metric score in the top five (it has nine in the bottom five). Thailand relies on imports to satisfy the lion's share of domestic demand for oil, natural gas, and coal, leading to import exposure risks that are much higher than, or moving higher against, the OECD average. In the power sector, oil capacity has been largely replaced by natural gas-fired capacity. Because the country's natural gas supplies are limited, the International Energy Agency is expecting coal's share of power production will increase by about half by 2035. The only areas where Thailand scores comparatively well are related to expenditures, energy use, and emissions per person. Other developing and emerging economies show the same thing. As these countries develop further, we can expect the risk score for these metrics to climb.

Turkey: Turkey's overall energy security risk score of 1,064 in 2014 puts it in the middle of the pack at number 14. In the 1980s, Turkey had some of the best scores in the group and achieved it highest rank of number three in 1984. In the second half of the 1980s, however, Turkey's overall risk score jumped owing to a sharp increase in risk related to natural gas imports needed to supply new gas-fired power stations. Since about 1990, its scores have stabilized somewhat against the OECD, averaging about 20% higher than this benchmark. Turkey's score in 2013 also was quite a bit more (17%) than its 1980 score, so its energy security have gotten worse both absolutely and relative to the OECD. Turkey produces only modest amounts of oil and natural gas, but is a significant producer of coal. Output of these fuels, however, is not enough to satisfy domestic demand. The diversity of the electricity power sector is near the OECD average, with generating capacity divided mainly among coal, natural gas, and hydroelectric. Like other emerging economies, Turkey's per capita metrics scores are much better than the comparable OECD averages.

Ukraine: Ukraine's energy security risks scores have been the worst energy security index scores of any country in the large energy user group, both

nominally and compared to the OECD, since 1992, the first year of available country-level data. Its scores over the period averaged about 175% higher than those for the OECD. However, Ukraine's overall risk has been trending downward since the mid-1990s, and recent trends suggest further, if slow, improvements. Ukraine is a large producer of coal, but it still must meet demand with imports. The Russian annexation of Crimea in 2014 and its support of anti-government rebels in eastern Ukraine, where there are large coal deposits, have impacted coal production. Ukraine also imports its supplies of oil and natural gas. Ukraine's power sector diversity risk used to be lower than the OECD average, but it is trending with higher with the shutdown of nuclear and natural gas facilities, the latter to reduce the need for Russian gas imports. Ukraine's energy, transportation energy, oil, and carbon intensity scores are the weakest among the large energy user group. As an economy in transition, it is not surprising that its energy use and emissions per capita measures are better than the OECD's, really about the only area where Ukraine does somewhat well. Ukraine has considerable room for improvement, with eight individual metrics ranked in the bottom five (only Thailand with nine has more).

United Kingdom: The United Kingdom has scored consistently in the top three most energy secure countries in the large energy user group, and it has been the most energy secure of the European countries. In 2014, however, its ranking dropped out of the top five for the first time, an indication that the United Kingdom's scores are moving in the wrong direction vis-à-vis its OECD peers, especially since 2005. Before 2005 the country's scores averaged about 16% below the OECD average. In 2014, its overall risk score was just 5% below. The biggest factors contributing to this trend have to do with rising risks surrounding natural gas and coal imports and very high retail electricity prices. The United Kingdom is a large energy producer, and while its oil import risk is better than the OECD average, the risks for natural gas and coal imports are not. The country is home to large oil and natural gas shale resources offshore and onshore. Its onshore shale resources are beginning to be explored for commercial production, which if successful could lower the import risks for these fuels. The United Kingdom's big advantage is that it has an energy efficient economy. Trends in the various energy use, transportation, and emissions metrics compare very favorably with the OECD average.

United States: From 1980 to 2000 period, U.S. energy security risk scores ran within a range of about 5% to 10% greater than the OECD average and ranked from number eight and 10. Since 2000, however, its scores have improved dramatically in relation to the OECD average, and by 2001, the U.S. score moved below that baseline. Its ranking within the large energy user group improved as well, especially after 2007. From number nine in that year, the United States climbed five places to number four in 2014. The largest drivers of this relative improvement have been related to increased domestic energy production—notably oil from the Bakken Shale formation in North Dakota and natural gas from the Barnett and Marcellus shale formations in Texas and Pennsylvania—and lower energy costs. The United States also is a large producer and a growing exporter of coal. The diversity of the U.S. power sector is roughly at the OECD average. Thermal capacity—mostly fired by coal (40%) and natural gas (55%), with very little oil—accounted for about 75% of total capacity in 2014, with nuclear accounting for about 10%, hydroelectric close to 8%, and non-hydro renewables about 6%. The United States has the fifth lowest average price for electricity in the large energy user group, a significant competitive advantage, but new Environmental Protection Agency rules covering emissions from existing power plants could push these higher. The United States is at a disadvantage relative to its OECD peers in metrics measuring energy use and emissions per capita and energy uses in transportation, but the differences generally are not all that large, and are shrinking.

Large Energy User Group Country Summaries

The summaries that follow provide brief snapshots of the energy security risks for each country in the large energy user group, including a description of how it compares to the OECD average and those factors that have had the greatest impact, both positively and negatively, on their energy security. The countries are listed in alphabetical order.

Included in each summary are:

1. A table showing current year and previous year total risk scores and those years with historically high and low risk scores both absolutely and relative to the OECD baseline average. (More detailed data on the energy security risks scores for each country are presented in Appendix 3.).

2. A chart showing the country's energy security risk trend and the OECD average trend since 1980.

3. A chart showing the country's risk trend relative to the OECD average (measured as percent variance) since 1980. This provides an indication of progress or deterioration in energy security risks compared to an international baseline

4. A chart showing trends in the country's risk ranking since 1980.

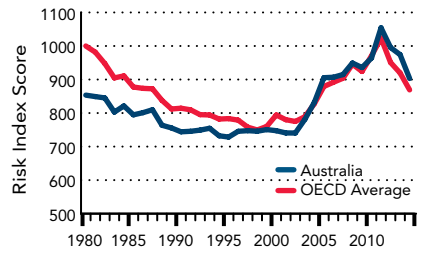
5. A table showing by metric grouping how the countries risk scores fare against the comparable OECD averages in five-year increments plus the most recent year of data. Cells highlighted in green indicate country risk scores at least 5% lower (better) than the comparable OECD scores while cells highlighted in red indicate country risk scores at least 5% higher (worse) than the comparable OECD scores. Cells with no highlighting indicate risk scores within 5% either way of the comparable OECD average. These tables provide an "at-a-glance" indication of how the country's metric groups have performed over time vis-à-vis the OECD average, with those cells in green performing considerably better and those in red performing considerably worse.

As a word of caution, because the data for many countries are not as robust or as detailed as U.S. data, readers should place less emphasis on precise values or changes in metrics from one year to the next and more emphasis on broader trends within and across countries is more suited to the available data.

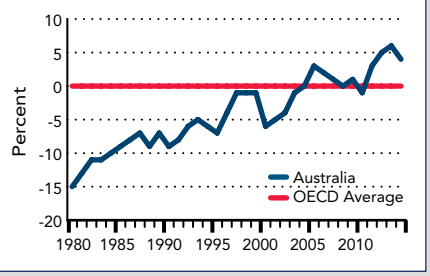
Australia

Energy Security Risk Summary: Australia			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	903	Average Annual Difference 1980-2014	-4.0%
2014 Large Energy User Group Rank	8	Best Relative Score	-15% (1980)
Score in Previous Year	974	Worst Relative Score	6% (2013)
Rank in Previous Year	10	**Country-Specific Metric Ranking—2014:**	
Score in 1980	853	Number in Top Five	2
Average Score: 1980-2014	825	Number in Bottom Five	4
Best Energy Security Risk Score	728 (1995)		
Worst Energy Security Risk Score	1,054 (2011)		

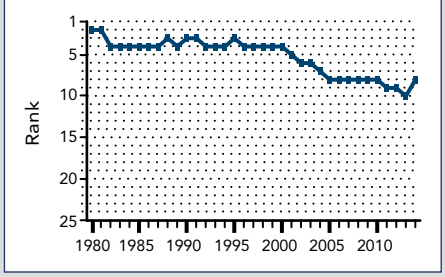
Australia vs. OECD: Risk Index Scores



Australia: Risk Variance from OECD



Australia: Risk Ranking



Australia vs. OECD: Percent Difference (Weighted Within Group)

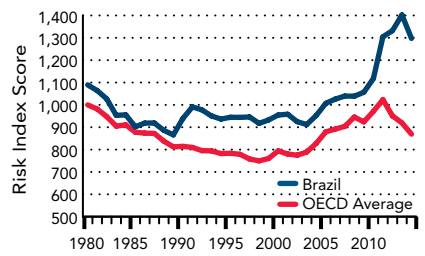
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-77	-100	-92	-84	-96	-70	-68	-54
Energy Expenditure Metrics	-17	-12	-12	-10	-8	4	5	7
Price & Market Volatility Metrics	-7	0	-6	-3	8	10	-2	15
Energy Use Intensity Metrics	-5	11	13	11	16	29	28	40
Electric Power Sector Metrics	19	32	41	47	48	44	42	35
Transportation Sector Metrics	24	52	40	33	33	40	14	10
Environmental Metrics	10	33	38	38	54	67	74	60
Total Weighted Index	**-15**	**-9**	**-9**	**-7**	**-6**	**3**	**-1**	**4**

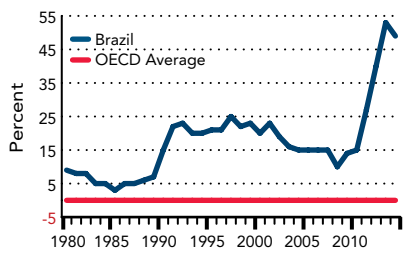
Brazil

Energy Security Risk Summary: Brazil			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,297	Average Annual Difference 1980-2014	18%
2014 Large Energy User Group Rank	23	Best Relative Score	3% (1985)
Score in Previous Year	1,402	Worst Relative Score	53% (2013)
Rank in Previous Year	23	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,090	Number in Top Five	3
Average Score: 1980-2014	1,011	Number in Bottom Five	4
Best Energy Security Risk Score	866 (1989)		
Worst Energy Security Risk Score	1,402 (2013)		

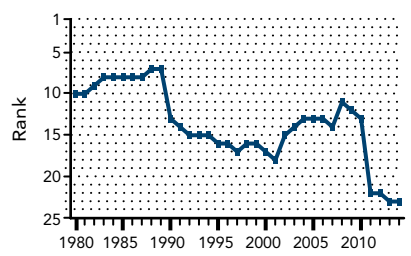
Brazil vs. OECD: Risk Index Scores



Brazil: Risk Variance from OECD



Brazil: Risk Ranking



Brazil vs. OECD: Percent Difference (Weighted Within Group)

(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

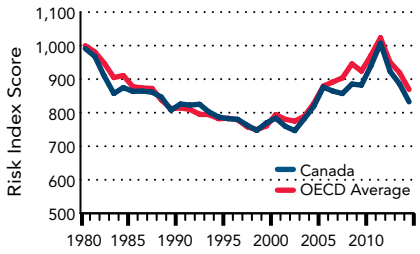
Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	46	-1	21	32	19	-0	-7	9
Energy Expenditure Metrics	12	14	27	-4	29	21	24	52
Price & Market Volatility Metrics	49	60	74	144	78	68	39	209
Energy Use Intensity Metrics	-33	-23	-7	-3	10	8	13	40
Electric Power Sector Metrics	14	20	28	31	19	8	2	-18
Transportation Sector Metrics	-35	-34	-14	-4	4	-1	16	81
Environmental Metrics	-42	-36	-25	-15	-4	-2	22	73
Total Weighted Index	**9**	**3**	**15**	**21**	**20**	**15**	**15**	**49**

Canada

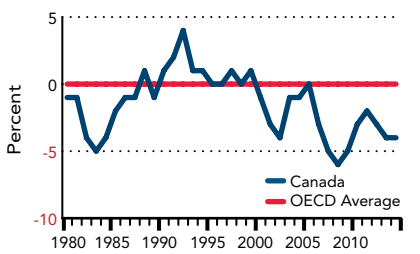
Energy Security Risk Summary: Canada

Risk Scores:		Risk Scores Relative to OECD Average:	
2014 Energy Security Risk Score	832	Average Annual Difference 1980-2014	-2%
2014 Large Energy User Group Rank	7	Best Relative Score	-6% (2008)
Score in Previous Year	886	Worst Relative Score	4% (1992)
Rank in Previous Year	7	**Country-Specific Metric Ranking—2014:**	
Score in 1980	991	Number in Top Five	7
Average Score: 1980-2014	846	Number in Bottom Five	4
Best Energy Security Risk Score	747 (2002)		
Worst Energy Security Risk Score	1,007 (2011)		

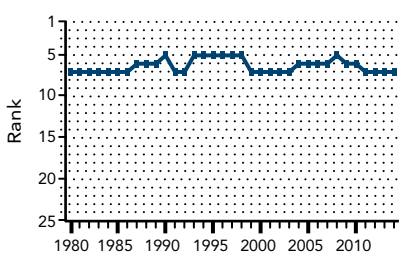
Canada vs. OECD: Risk Index Scores



Canada: Risk Variance from OECD



Canada: Risk Ranking



Canada vs. OECD: Percent Difference (Weighted Within Group)

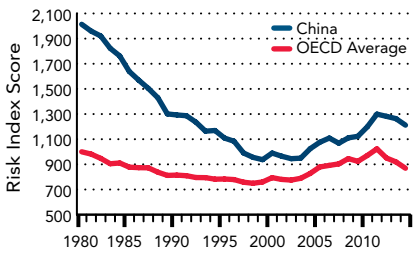
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-93	-100	-100	-100	-100	-100	-100	-100
Energy Expenditure Metrics	-19	-7	-3	-18	-8	5	-2	5
Price & Market Volatility Metrics	-7	-14	9	14	5	14	9	-7
Energy Use Intensity Metrics	78	82	85	88	83	87	76	81
Electric Power Sector Metrics	-21	-20	-23	-23	-19	-23	-23	-21
Transportation Sector Metrics	120	90	76	72	63	60	68	65
Environmental Metrics	32	30	29	31	33	37	24	25
Total Weighted Index	**-1**	**-2**	**1**	**-0**	**-1**	**-0**	**-3**	**-4**

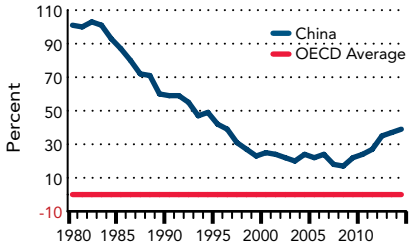
China

Energy Security Risk Summary: China			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,212	Average Annual Difference 1980-2014	48%
2014 Large Energy User Group Rank	21	Best Relative Score	17% (2008)
Score in Previous Year	1,263	Worst Relative Score	103% (1982)
Rank in Previous Year	21	**Country-Specific Metric Ranking—2014:**	
Score in 1980	2,014	Number in Top Five	5
Average Score: 1980-2014	1,279	Number in Bottom Five	7
Best Energy Security Risk Score	937 (1999)		
Worst Energy Security Risk Score	2,014 (1980)		

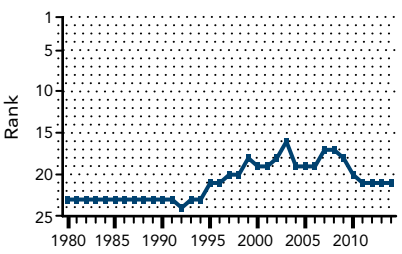
China vs. OECD: Risk Index Scores



China: Risk Variance from OECD



China: Risk Ranking



China vs. OECD: Percent Difference (Weighted Within Group)

(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

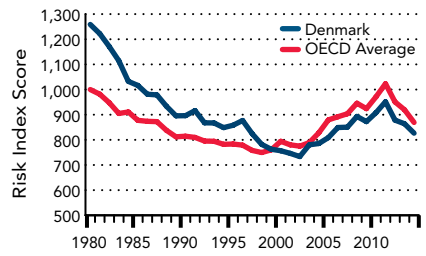
Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-100	-100	-100	-92	-73	-62	-44	-38
Energy Expenditure Metrics	23	3	-16	-37	-22	-24	-13	-5
Price & Market Volatility Metrics	294	348	270	307	156	89	36	93
Energy Use Intensity Metrics	389	335	249	172	119	129	118	130
Electric Power Sector Metrics	3	14	28	32	34	36	35	45
Transportation Sector Metrics	-47	-51	-55	-57	-56	-52	-33	-11
Environmental Metrics	306	258	199	149	118	179	249	376
Total Weighted Index	**101**	**87**	**59**	**42**	**25**	**22**	**24**	**39**

Denmark

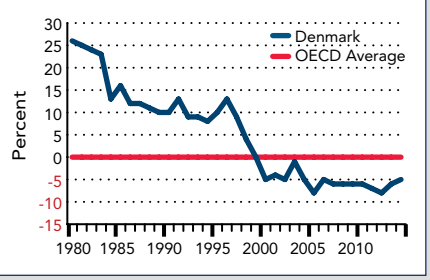
Energy Security Risk Summary: Denmark

Risk Scores:		Risk Scores Relative to OECD Average:	
2014 Energy Security Risk Score	827	Average Annual Difference 1980-2014	5%
2014 Large Energy User Group Rank	5	Best Relative Score	-8% (2005)
Score in Previous Year	864	Worst Relative Score	26% (1980)
Rank in Previous Year	4	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,259	Number in Top Five	9
Average Score: 1980-2014	903	Number in Bottom Five	2
Best Energy Security Risk Score	734 (2002)		
Worst Energy Security Risk Score	1,259 (1980)		

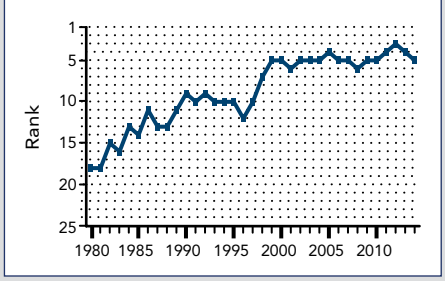
Denmark vs. OECD: Risk Index Scores



Denmark: Risk Variance from OECD



Denmark: Risk Ranking



Denmark vs. OECD: Percent Difference (Weighted Within Group)

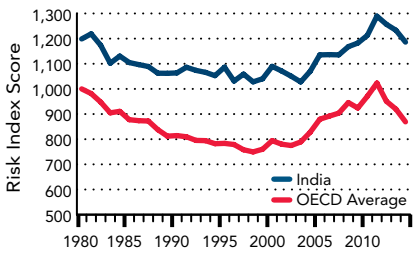
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	155	97	41	36	4	-10	-10	-13
Energy Expenditure Metrics	15	0	22	33	27	29	25	23
Price & Market Volatility Metrics	-6	-2	12	3	-8	-14	-11	-1
Energy Use Intensity Metrics	-26	-30	-35	-32	-36	-39	-38	-41
Electric Power Sector Metrics	63	81	80	63	19	3	4	8
Transportation Sector Metrics	-43	-36	-33	-30	-29	-27	-19	-18
Environmental Metrics	-5	-2	-14	-0	-27	-32	-36	-33
Total Weighted Index	**26**	**16**	**10**	**10**	**-5**	**-8**	**-6**	**-5**

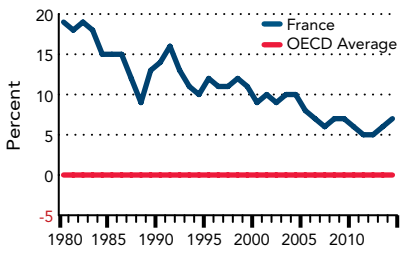
France

Energy Security Risk Summary: France			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	932	Average Annual Difference 1980-2014	11%
2014 Large Energy User Group Rank	10	Best Relative Score	5% (2011)
Score in Previous Year	974	Worst Relative Score	19% (1982)
Rank in Previous Year	9	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,187	Number in Top Five	6
Average Score: 1980-2014	954	Number in Bottom Five	3
Best Energy Security Risk Score	841 (1997)		
Worst Energy Security Risk Score	1,187 (1980)		

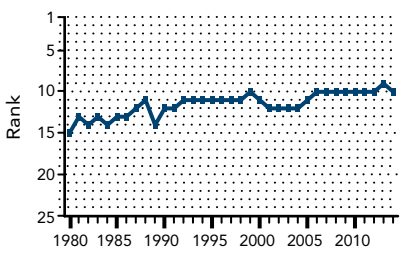
France vs. OECD: Risk Index Scores



France: Risk Variance from OECD



France: Risk Ranking



France vs. OECD: Percent Difference (Weighted Within Group)

(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	147	155	119	101	106	95	90	92
Energy Expenditure Metrics	17	-6	7	5	-12	-9	-6	-5
Price & Market Volatility Metrics	-1	-8	8	11	-6	-6	-6	-4
Energy Use Intensity Metrics	-25	-25	-24	-21	-20	-18	-19	-19
Electric Power Sector Metrics	-38	-32	-19	-17	-17	-15	-19	-22
Transportation Sector Metrics	-32	-32	-28	-26	-25	-31	-35	-35
Environmental Metrics	-19	-31	-39	-40	-40	-40	-40	-42
Total Weighted Index	**19**	**15**	**14**	**12**	**9**	**8**	**6**	**7**

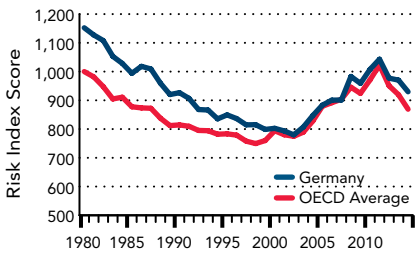
Germany

Energy Security Risk Summary: Germany

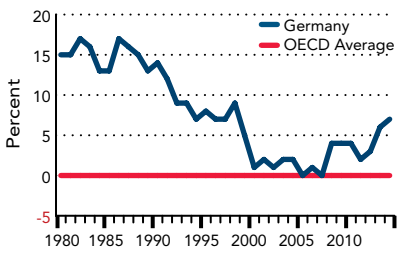
Risk Scores:	
2014 Energy Security Risk Score	930
2014 Large Energy User Group Rank	9
Score in Previous Year	970
Rank in Previous Year	8
Score in 1980	1,152
Average Score: 1980-2014	928
Best Energy Security Risk Score	780 (2002)
Worst Energy Security Risk Score	1,152 (1980)

Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2014	8%
Best Relative Score	0% (2007)
Worst Relative Score	17% (1982)
Country-Specific Metric Ranking—2014:	
Number in Top Five	5
Number in Bottom Five	1

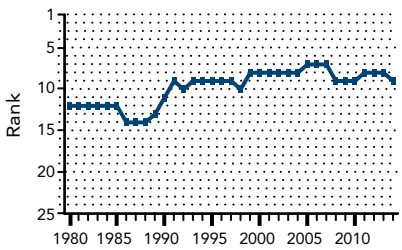
Germany vs. OECD: Risk Index Scores



Germany: Risk Variance from OECD



Germany: Risk Ranking



Germany vs. OECD: Percent Difference (Weighted Within Group)

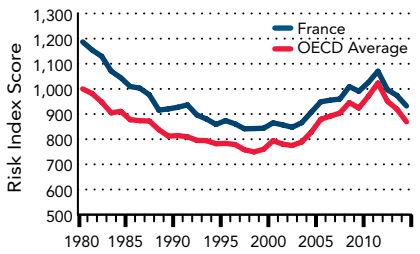
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	74	76	58	50	50	37	49	47
Energy Expenditure Metrics	21	5	29	37	-8	10	19	25
Price & Market Volatility Metrics	3	4	7	-10	-2	-4	-5	-5
Energy Use Intensity Metrics	-10	-5	-11	-19	-22	-21	-20	-20
Electric Power Sector Metrics	18	14	13	7	-2	-13	-20	-5
Transportation Sector Metrics	-33	-30	-24	-26	-28	-36	-38	-37
Environmental Metrics	7	10	2	-14	-22	-23	-24	-27
Total Weighted Index	**15**	**13**	**14**	**8**	**1**	**0**	**4**	**7**

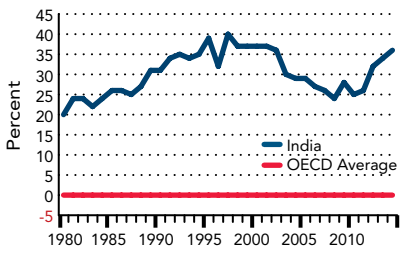
India

Energy Security Risk Summary: India			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,186	Average Annual Difference 1980-2014	30%
2014 Large Energy User Group Rank	19	Best Relative Score	20% (1980)
Score in Previous Year	1,233	Worst Relative Score	40% (1997)
Rank in Previous Year	20	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,199	Number in Top Five	5
Average Score: 1980-2014	1,116	Number in Bottom Five	4
Best Energy Security Risk Score	1,028 (2003)		
Worst Energy Security Risk Score	1,289 (2011)		

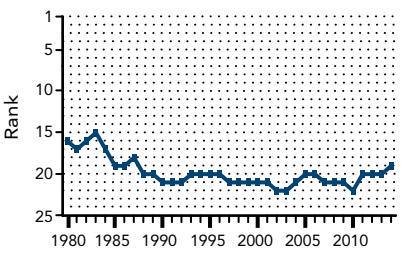
India vs. OECD: Risk Index Scores



India: Risk Variance from OECD



India: Risk Ranking



India vs. OECD: Percent Difference (Weighted Within Group)

(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

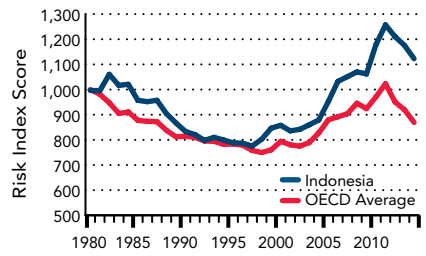
Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-21	-63	-54	-43	-25	-13	3	-2
Energy Expenditure Metrics	-29	-24	-34	-50	-28	-23	-26	-22
Price & Market Volatility Metrics	192	246	268	309	242	167	70	164
Energy Use Intensity Metrics	33	69	75	95	80	65	63	74
Electric Power Sector Metrics	-8	8	19	30	25	19	24	24
Transportation Sector Metrics	-64	-49	-43	-23	-51	-60	-48	-27
Environmental Metrics	14	60	73	123	114	122	184	300
Total Weighted Index	**20**	**26**	**31**	**39**	**37**	**29**	**25**	**36**

Indonesia

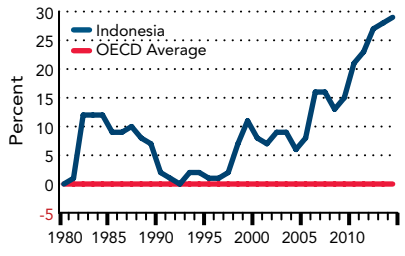
Energy Security Risk Summary: Indonesia

Risk Scores:		Risk Scores Relative to OECD Average:	
2014 Energy Security Risk Score	1,123	Average Annual Difference 1980-2014	10%
2014 Large Energy User Group Rank	17	Best Relative Score	0% (1980)
Score in Previous Year	1,175	Worst Relative Score	29% (2014)
Rank in Previous Year	17	**Country-Specific Metric Ranking—2014:**	
Score in 1980	996	Number in Top Five	7
Average Score: 1980-2014	948	Number in Bottom Five	6
Best Energy Security Risk Score	775 (1997)		
Worst Energy Security Risk Score	1,257 (2011)		

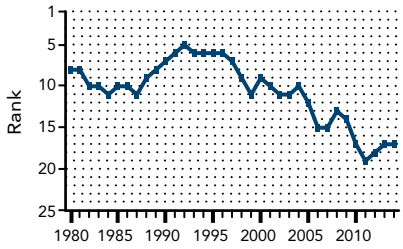
Indonesia vs. OECD: Risk Index Scores



Indonesia: Risk Variance from OECD



Indonesia: Risk Ranking



Indonesia vs. OECD: Percent Difference (Weighted Within Group)

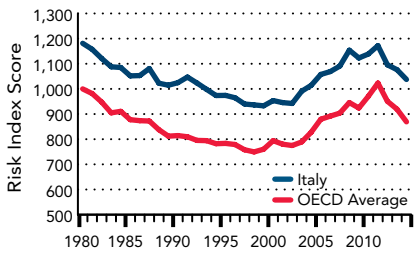
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-98	-100	-100	-100	-100	-86	-58	-31
Energy Expenditure Metrics	-26	-14	-26	-30	-54	-28	-19	-8
Price & Market Volatility Metrics	121	179	152	190	184	124	95	162
Energy Use Intensity Metrics	23	32	44	32	62	60	69	68
Electric Power Sector Metrics	57	70	27	13	10	16	20	37
Transportation Sector Metrics	-48	-45	-46	-42	-24	-30	-17	-9
Environmental Metrics	-6	2	31	50	78	102	150	191
Total Weighted Index	**-0**	**9**	**2**	**1**	**8**	**8**	**21**	**29**

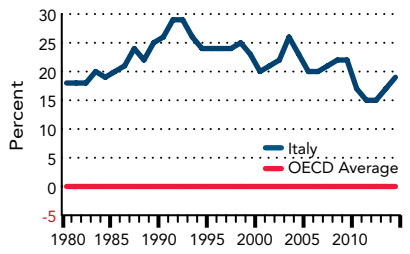
Italy

Energy Security Risk Summary: Italy			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,038	Average Annual Difference 1980-2014	22%
2014 Large Energy User Group Rank	13	Best Relative Score	15% (2011)
Score in Previous Year	1,077	Worst Relative Score	29% (1991)
Rank in Previous Year	13	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,181	Number in Top Five	4
Average Score: 1980-2014	1,044	Number in Bottom Five	3
Best Energy Security Risk Score	933 (1999)		
Worst Energy Security Risk Score	1,181 (1980)		

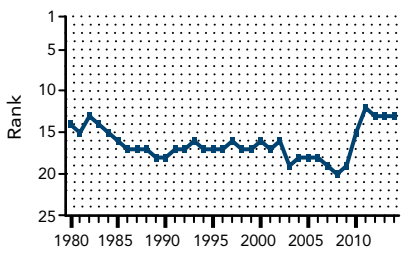
Italy vs. OECD: Risk Index Scores



Italy: Risk Variance from OECD



Italy: Risk Ranking



Italy vs. OECD: Percent Difference (Weighted Within Group)

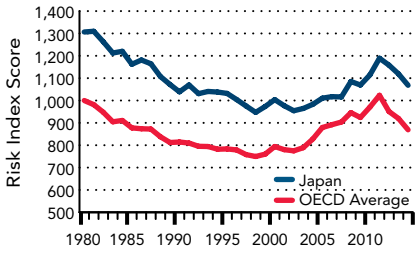
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	169	177	149	140	127	109	106	101
Energy Expenditure Metrics	2	3	34	27	24	31	30	29
Price & Market Volatility Metrics	-5	-12	12	19	3	-1	-4	5
Energy Use Intensity Metrics	-39	-38	-35	-36	-34	-31	-31	-32
Electric Power Sector Metrics	-5	-12	1	7	2	6	3	-3
Transportation Sector Metrics	-38	-31	-26	-26	-26	-24	-27	-24
Environmental Metrics	-29	-26	-18	-18	-19	-17	-21	-22
Total Weighted Index	**18**	**20**	**26**	**24**	**20**	**20**	**17**	**19**

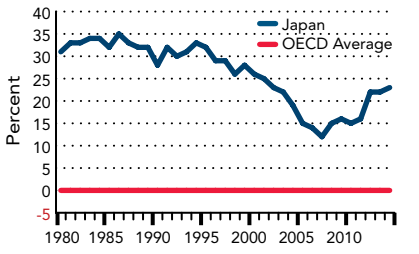
Japan

Energy Security Risk Summary: Japan			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,068	Average Annual Difference 1980-2014	26%
2014 Large Energy User Group Rank	15	Best Relative Score	12% (2007)
Score in Previous Year	1,119	Worst Relative Score	35% (1986)
Rank in Previous Year	15	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,306	Number in Top Five	3
Average Score: 1980-2014	1,082	Number in Bottom Five	6
Best Energy Security Risk Score	947 (1998)		
Worst Energy Security Risk Score	1,310 (1981)		

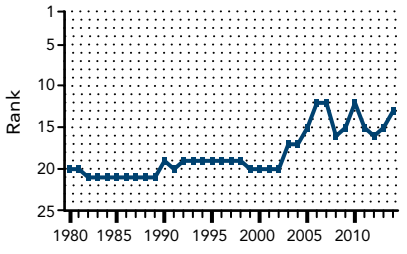
Japan vs. OECD: Risk Index Scores



Japan: Risk Variance from OECD



Japan: Risk Ranking



Japan vs. OECD: Percent Difference (Weighted Within Group)

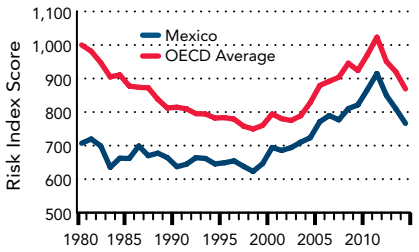
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	203	220	171	158	139	114	112	124
Energy Expenditure Metrics	27	28	39	76	51	13	14	14
Price & Market Volatility Metrics	1	2	-3	-8	2	-17	-7	7
Energy Use Intensity Metrics	-28	-31	-26	-23	-19	-19	-19	-20
Electric Power Sector Metrics	-14	-21	-18	-18	-19	-18	-13	16
Transportation Sector Metrics	-46	-48	-41	-37	-35	-39	-39	-38
Environmental Metrics	-21	-21	-16	-14	-11	-10	-8	-6
Total Weighted Index	**31**	**32**	**28**	**32**	**26**	**15**	**15**	**23**

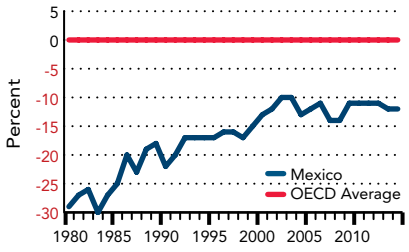
Mexico

Energy Security Risk Summary: Mexico			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	766	Average Annual Difference 1980-2014	-17%
2014 Large Energy User Group Rank	2	Best Relative Score	-30% (1983)
Score in Previous Year	809	Worst Relative Score	-10% (2003)
Rank in Previous Year	2	**Country-Specific Metric Ranking—2014:**	
Score in 1980	707	Number in Top Five	7
Average Score: 1980-2014	713	Number in Bottom Five	0
Best Energy Security Risk Score	623 (1998)		
Worst Energy Security Risk Score	915 (2011)		

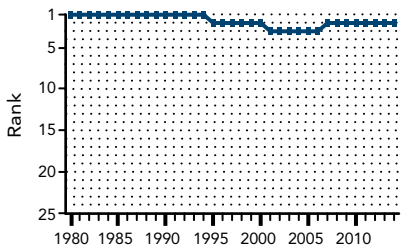
Mexico vs. OECD: Risk Index Scores



Mexico: Risk Variance from OECD



Mexico: Risk Ranking



Mexico vs. OECD: Percent Difference (Weighted Within Group)

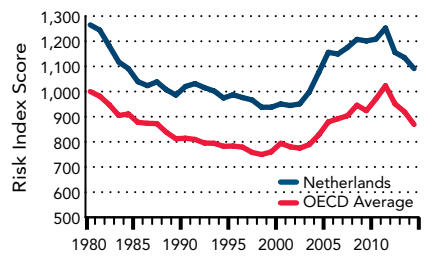
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-76	-89	-97	-70	-70	-47	-58	-59
Energy Expenditure Metrics	-38	-42	-38	-48	-20	-17	-23	-21
Price & Market Volatility Metrics	-3	17	39	72	60	15	12	22
Energy Use Intensity Metrics	-25	-10	-8	-7	-9	-9	-7	-4
Electric Power Sector Metrics	-1	7	5	-2	1	4	16	20
Transportation Sector Metrics	-41	-36	-13	-15	-14	-10	11	5
Environmental Metrics	-28	-13	-11	-11	-6	-6	6	13
Total Weighted Index	**-29**	**-25**	**-22**	**-17**	**-13**	**-12**	**-11**	**-12**

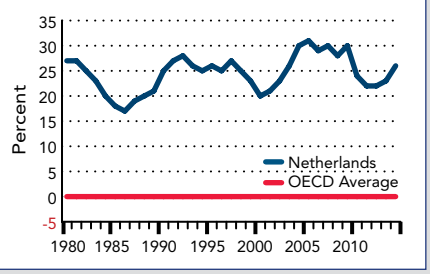
Netherlands

Energy Security Risk Summary: Netherlands			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,091	Average Annual Difference 1980-2014	25%
2014 Large Energy User Group Rank	16	Best Relative Score	17% (1986)
Score in Previous Year	1,135	Worst Relative Score	31% (2005)
Rank in Previous Year	16	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,265	Number in Top Five	2
Average Score: 1980-2014	1,071	Number in Bottom Five	5
Best Energy Security Risk Score	938 (1999)		
Worst Energy Security Risk Score	1,265 (1980)		

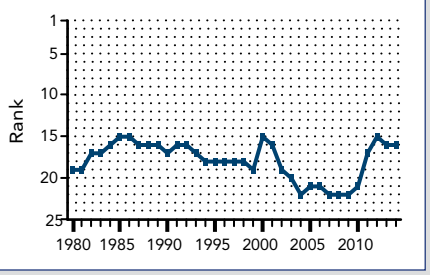
Netherlands vs. OECD: Risk Index Scores



Netherlands: Risk Variance from OECD



Netherlands: Risk Ranking



Netherlands vs. OECD: Percent Difference (Weighted Within Group)

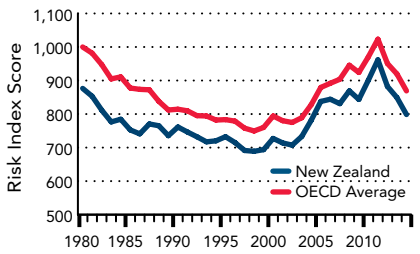
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	103	78	71	75	63	56	62	70
Energy Expenditure Metrics	34	14	26	45	30	68	36	31
Price & Market Volatility Metrics	7	2	36	15	2	32	9	-1
Energy Use Intensity Metrics	5	2	6	4	2	14	17	18
Electric Power Sector Metrics	31	46	46	47	44	32	38	34
Transportation Sector Metrics	-28	-28	-22	-22	-21	-16	-5	-3
Environmental Metrics	8	8	13	12	14	20	20	22
Total Weighted Index	**27**	**18**	**25**	**26**	**20**	**31**	**24**	**26**

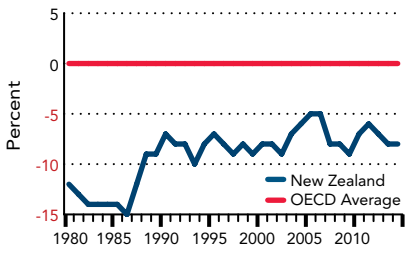
New Zealand

Energy Security Risk Summary: New Zealand			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	799	Average Annual Difference 1980-2014	-9%
2014 Large Energy User Group Rank	3	Best Relative Score	-15% (1986)
Score in Previous Year	849	Worst Relative Score	-5% (2005)
Rank in Previous Year	3	**Country-Specific Metric Ranking—2014:**	
Score in 1980	876	Number in Top Five	5
Average Score: 1980-2014	781	Number in Bottom Five	1
Best Energy Security Risk Score	689 (1998)		
Worst Energy Security Risk Score	962 (2011)		

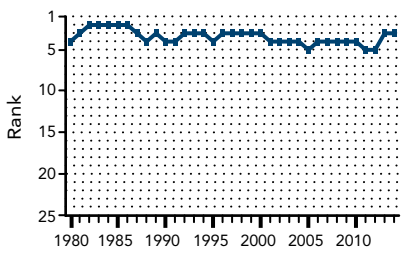
New Zealand vs. OECD: Risk Index Scores



New Zealand: Risk Variance from OECD



New Zealand : Risk Ranking



New Zealand vs. OECD: Percent Difference (Weighted Within Group)

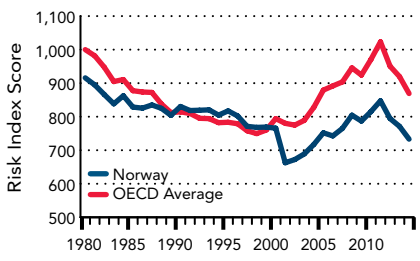
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-23	-46	-65	-57	-58	-46	-57	-46
Energy Expenditure Metrics	-25	-31	-19	-18	-26	-7	-8	-3
Price & Market Volatility Metrics	-8	-6	20	10	11	7	12	-5
Energy Use Intensity Metrics	-14	-4	19	14	13	5	7	5
Electric Power Sector Metrics	-5	-9	-7	-1	-12	-18	-21	-27
Transportation Sector Metrics	26	23	42	42	37	47	26	24
Environmental Metrics	-28	-14	5	4	12	19	14	16
Total Weighted Index	**-12**	**-14**	**-7**	**-7**	**-8**	**-5**	**-7**	**-8**

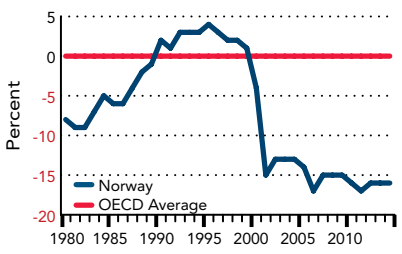
Norway

Energy Security Risk Summary: Norway			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	733	Average Annual Difference 1980-2014	-7%
2014 Large Energy User Group Rank	1	Best Relative Score	-17% (2011)
Score in Previous Year	771	Worst Relative Score	4% (1995)
Rank in Previous Year	1	**Country-Specific Metric Ranking—2014:**	
Score in 1980	916	Number in Top Five	11
Average Score: 1980-2014	795	Number in Bottom Five	3
Best Energy Security Risk Score	663 (2001)		
Worst Energy Security Risk Score	916 (1980)		

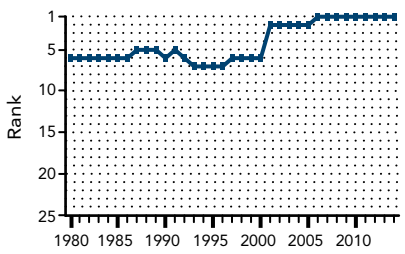
Norway vs. OECD: Risk Index Scores



Norway: Risk Variance from OECD



Norway: Risk Ranking



Norway vs. OECD: Percent Difference (Weighted Within Group)

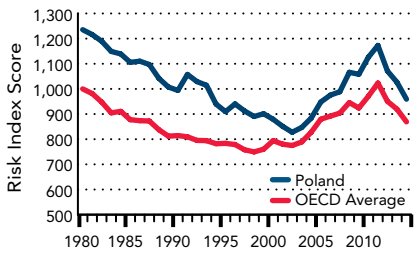
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-21	-32	-34	-16	-46	-100	-100	-99
Energy Expenditure Metrics	-20	-24	-7	-1	-10	5	9	1
Price & Market Volatility Metrics	-17	-25	-3	-11	-11	-15	-18	-15
Energy Use Intensity Metrics	12	31	42	34	40	36	30	37
Electric Power Sector Metrics	39	47	49	54	46	46	42	51
Transportation Sector Metrics	-14	6	16	9	1	1	-23	-24
Environmental Metrics	-29	-25	-25	-22	-21	-21	-12	-9
Total Weighted Index	**-8**	**-6**	**2**	**4**	**-4**	**-14**	**-16**	**-16**

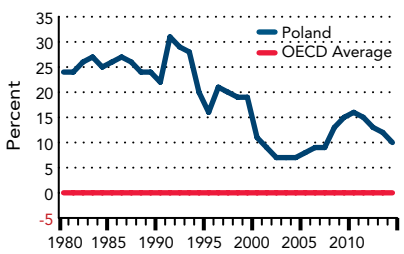
Poland

Energy Security Risk Summary: Poland			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	959	Average Annual Difference 1980-2014	18%
2014 Large Energy User Group Rank	11	Best Relative Score	7% (2004)
Score in Previous Year	1,026	Worst Relative Score	31% (1991)
Rank in Previous Year	11	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,235	Number in Top Five	2
Average Score: 1980-2014	1,016	Number in Bottom Five	2
Best Energy Security Risk Score	828 (2002)		
Worst Energy Security Risk Score	1,235 (1980)		

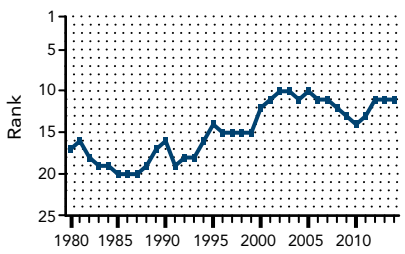
Poland vs. OECD: Risk Index Scores



Poland: Risk Variance from OECD



Poland : Risk Ranking



Poland vs. OECD: Percent Difference (Weighted Within Group)

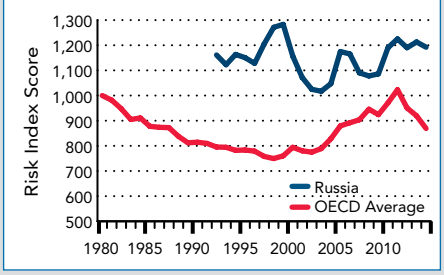
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	43	44	43	9	6	2	11	4
Energy Expenditure Metrics	-36	-40	-50	-25	-21	-10	0	-3
Price & Market Volatility Metrics	21	31	36	48	43	29	40	55
Energy Use Intensity Metrics	84	82	70	46	23	16	14	7
Electric Power Sector Metrics	69	80	87	90	86	78	74	70
Transportation Sector Metrics	-37	-40	-44	-43	-38	-31	-5	-9
Environmental Metrics	106	98	68	42	11	-0	1	0
Total Weighted Index	**24**	**26**	**22**	**16**	**11**	**8**	**16**	**10**

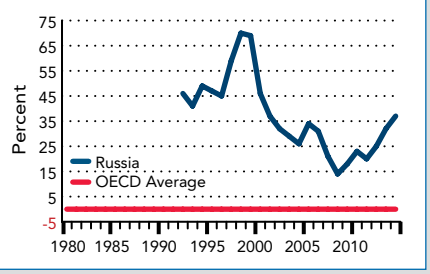
Russia

Energy Security Risk Summary: Russia			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,192	Average Annual Difference 1980-2014	37%
2014 Large Energy User Group Rank	20	Best Relative Score	14% (2008)
Score in Previous Year	1,213	Worst Relative Score	70% (1998)
Rank in Previous Year	18	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,161	Number in Top Five	5
Average Score: 1980-2014	1,148	Number in Bottom Five	7
Best Energy Security Risk Score	1,017 (2003)		
Worst Energy Security Risk Score	1,283 (1999)		

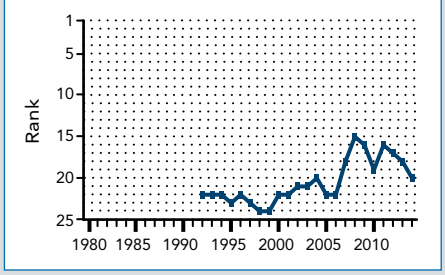
Russia vs. OECD: Risk Index Scores



Russia: Risk Variance from OECD



Russia: Risk Ranking



Russia vs. OECD: Percent Difference (Weighted Within Group)

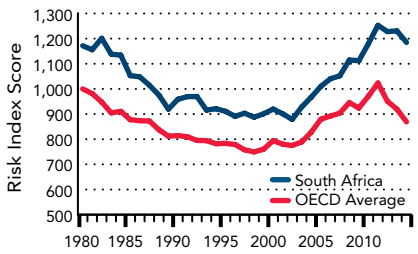
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	N/A	N/A	N/A	0	0	0	0	0
Fuel Import Metrics	N/A	N/A	N/A	-100	-100	-100	-100	-100
Energy Expenditure Metrics	N/A	N/A	N/A	-19	-8	-4	2	11
Price & Market Volatility Metrics	N/A	N/A	N/A	89	149	153	52	94
Energy Use Intensity Metrics	N/A	N/A	N/A	318	273	218	211	259
Electric Power Sector Metrics	N/A	N/A	N/A	-5	-7	-5	2	6
Transportation Sector Metrics	N/A	N/A	N/A	10	3	-8	18	82
Environmental Metrics	N/A	N/A	N/A	154	124	95	92	144
Total Weighted Index	**N/A**	**N/A**	**N/A**	**47**	**46**	**34**	**23**	**37**

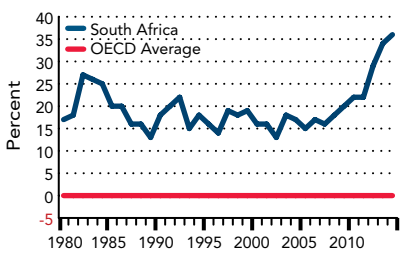
South Africa

Energy Security Risk Summary: South Africa			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,185	Average Annual Difference 1980-2014	20%
2014 Large Energy User Group Rank	18	Best Relative Score	13% (1989)
Score in Previous Year	1,231	Worst Relative Score	36% (2014)
Rank in Previous Year	19	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,172	Number in Top Five	3
Average Score: 1980-2014	1,030	Number in Bottom Five	5
Best Energy Security Risk Score	879 (2002)		
Worst Energy Security Risk Score	1,253 (2011)		

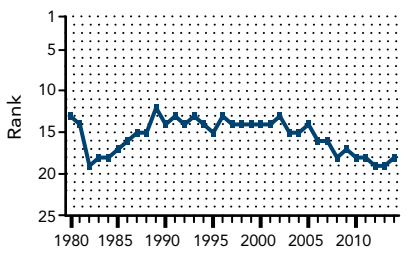
South Africa vs. OECD: Risk Index Scores



South Africa: Risk Variance from OECD



South Africa: Risk Ranking



South Africa vs. OECD: Percent Difference (Weighted Within Group)

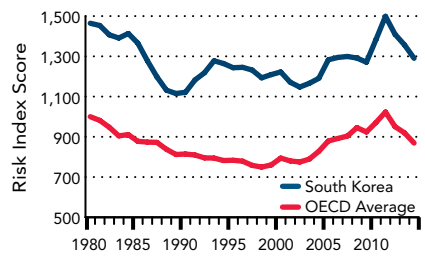
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-13	-30	-34	-63	-61	-56	-15	-10
Energy Expenditure Metrics	6	-26	-25	-31	-30	-23	-19	-9
Price & Market Volatility Metrics	43	67	61	70	60	62	42	91
Energy Use Intensity Metrics	31	74	68	84	85	81	81	107
Electric Power Sector Metrics	79	68	74	78	77	78	86	96
Transportation Sector Metrics	-15	-7	-5	1	-5	-6	-7	42
Environmental Metrics	47	93	78	96	91	90	104	156
Total Weighted Index	**17**	**20**	**18**	**16**	**16**	**15**	**22**	**36**

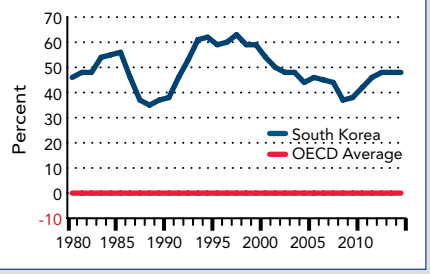
South Korea

Energy Security Risk Summary: South Korea			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,290	Average Annual Difference 1980-2014	49%
2014 Large Energy User Group Rank	22	Best Relative Score	35% (1988)
Score in Previous Year	1,357	Worst Relative Score	63% (1997)
Rank in Previous Year	22	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,464	Number in Top Five	0
Average Score: 1980-2014	1,277	Number in Bottom Five	6
Best Energy Security Risk Score	1,115 (1989)		
Worst Energy Security Risk Score	1,499 (2011)		

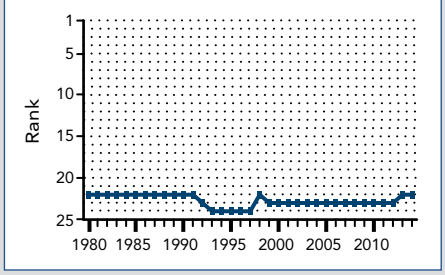
South Korea vs. OECD: Risk Index Scores



South Korea: Risk Variance from OECD



South Korea: Risk Ranking



South Korea vs. OECD: Percent Difference (Weighted Within Group)

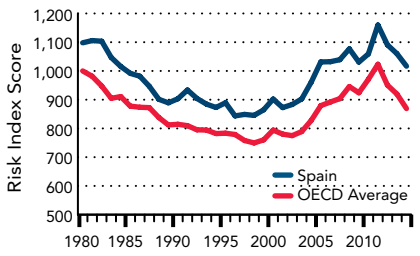
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	181	221	187	203	174	147	150	157
Energy Expenditure Metrics	43	23	3	32	23	19	12	18
Price & Market Volatility Metrics	75	151	40	62	70	38	17	17
Energy Use Intensity Metrics	2	-6	9	35	35	34	41	46
Electric Power Sector Metrics	33	-9	-18	-7	-5	-5	5	9
Transportation Sector Metrics	-88	-55	-42	-16	-26	-20	-23	-25
Environmental Metrics	-8	6	23	71	79	91	133	148
Total Weighted Index	**46**	**56**	**38**	**59**	**54**	**46**	**42**	**48**

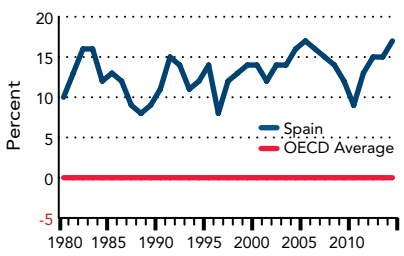
Spain

Energy Security Risk Summary: Spain			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,017	Average Annual Difference 1980-2014	13%
2014 Large Energy User Group Rank	12	Best Relative Score	8% (1988)
Score in Previous Year	1,060	Worst Relative Score	17% (2005)
Rank in Previous Year	12	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,098	Number in Top Five	1
Average Score: 1980-2014	971	Number in Bottom Five	4
Best Energy Security Risk Score	844 (1996)		
Worst Energy Security Risk Score	1,160 (2011)		

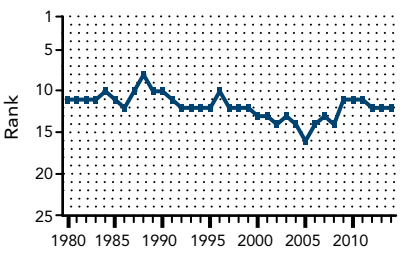
Spain vs. OECD: Risk Index Scores



Spain: Risk Variance from OECD



Spain: Risk Ranking



Spain vs. OECD: Percent Difference (Weighted Within Group)

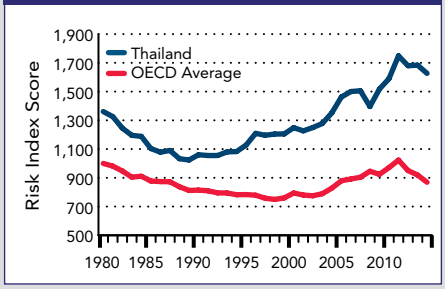
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	142	142	96	110	107	96	74	98
Energy Expenditure Metrics	-9	-10	21	11	-9	4	6	6
Price & Market Volatility Metrics	-3	9	9	10	7	11	-1	8
Energy Use Intensity Metrics	-41	-36	-33	-30	-21	-16	-19	-19
Electric Power Sector Metrics	-16	-26	-29	-26	-30	-28	-33	-25
Transportation Sector Metrics	-49	-40	-31	-29	-16	-8	-9	-5
Environmental Metrics	-31	-23	-21	-18	-1	12	-3	2
Total Weighted Index	**10**	**13**	**11**	**14**	**14**	**17**	**9**	**17**

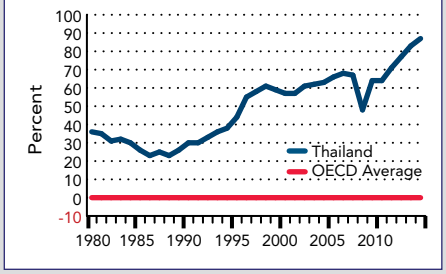
Thailand

Energy Security Risk Summary: Thailand			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,627	Average Annual Difference 1980-2014	49%
2014 Large Energy User Group Rank	24	Best Relative Score	23% (1988)
Score in Previous Year	1,684	Worst Relative Score	87% (2014)
Rank in Previous Year	24	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,361	Number in Top Five	0
Average Score: 1980-2014	1,285	Number in Bottom Five	9
Best Energy Security Risk Score	1,024 (1989)		
Worst Energy Security Risk Score	1,749 (2011)		

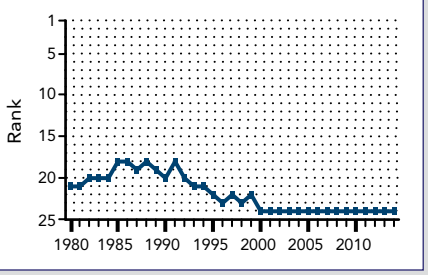
Thailand vs. OECD: Risk Index Scores



Thailand: Risk Variance from OECD



Thailand: Risk Ranking



Thailand vs. OECD: Percent Difference (Weighted Within Group)

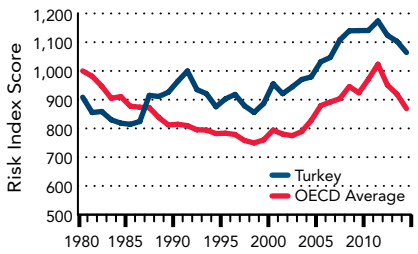
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	97	24	43	52	48	72	80	66
Energy Expenditure Metrics	6	-4	-15	-5	-5	-0	21	33
Price & Market Volatility Metrics	120	156	109	108	156	108	54	159
Energy Use Intensity Metrics	15	21	40	56	84	107	116	144
Electric Power Sector Metrics	27	5	12	23	40	47	61	46
Transportation Sector Metrics	-32	-8	12	46	42	53	28	90
Environmental Metrics	-20	-0	52	125	141	235	291	408
Total Weighted Index	**36**	**26**	**30**	**44**	**57**	**66**	**64**	**87**

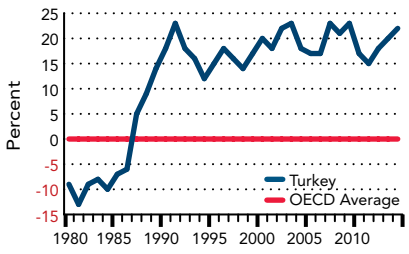
Turkey

Energy Security Risk Summary: Turkey			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,064	Average Annual Difference 1980-2014	12%
2014 Large Energy User Group Rank	14	Best Relative Score	-13% (1981)
Score in Previous Year	1,103	Worst Relative Score	23% (1991)
Rank in Previous Year	14	**Country-Specific Metric Ranking—2014:**	
Score in 1980	909	Number in Top Five	3
Average Score: 1980-2014	961	Number in Bottom Five	3
Best Energy Security Risk Score	814 (1985)		
Worst Energy Security Risk Score	1,174 (2011)		

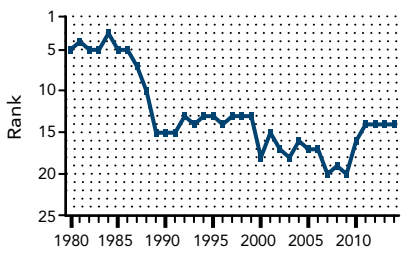
Turkey vs. OECD: Risk Index Scores



Turkey: Risk Variance from OECD



Turkey: Risk Ranking



Turkey vs. OECD: Percent Difference (Weighted Within Group)

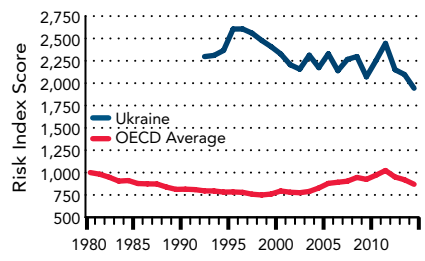
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	12	2	104	82	90	78	77	89
Energy Expenditure Metrics	-11	-22	-10	-17	-4	1	7	3
Price & Market Volatility Metrics	32	57	79	88	66	40	14	37
Energy Use Intensity Metrics	-45	-39	-29	-24	-20	-23	-18	-14
Electric Power Sector Metrics	-14	-4	-8	-8	-2	4	6	11
Transportation Sector Metrics	-58	-56	-49	-44	-51	-56	-50	-55
Environmental Metrics	-39	-18	5	16	41	53	85	105
Total Weighted Index	**-9**	**-7**	**18**	**15**	**20**	**17**	**17**	**22**

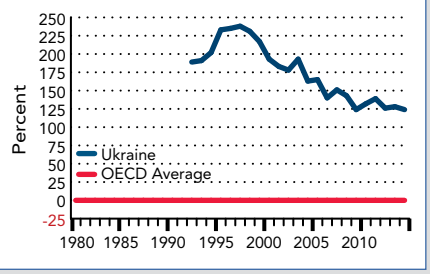
Ukraine

Energy Security Risk Summary: Ukraine			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	1,944	Average Annual Difference 1980-2014	175%
2014 Large Energy User Group Rank	25	Best Relative Score	124% (2014)
Score in Previous Year	2,097	Worst Relative Score	238% (1997)
Rank in Previous Year	25	**Country-Specific Metric Ranking—2014:**	
Score in 1980	2,297	Number in Top Five	2
Average Score: 1980-2014	2,295	Number in Bottom Five	8
Best Energy Security Risk Score	1,944 (2014)		
Worst Energy Security Risk Score	2,606 (1996)		

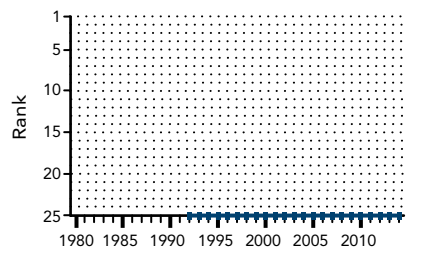
Ukraine vs. OECD: Risk Index Scores



Ukraine: Risk Variance from OECD



Ukraine: Risk Ranking



Ukraine vs. OECD: Percent Difference (Weighted Within Group)

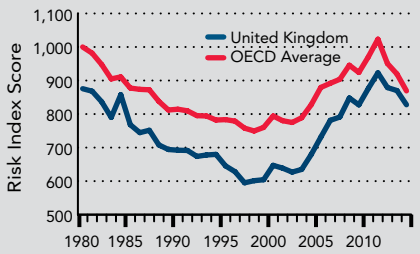
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	N/A	N/A	N/A	0	0	0	0	0
Fuel Import Metrics	N/A	N/A	N/A	257	201	208	122	80
Energy Expenditure Metrics	N/A	N/A	N/A	156	142	118	65	63
Price & Market Volatility Metrics	N/A	N/A	N/A	293	200	221	247	220
Energy Use Intensity Metrics	N/A	N/A	N/A	637	573	451	345	441
Electric Power Sector Metrics	N/A	N/A	N/A	-8	-10	-13	-8	-2
Transportation Sector Metrics	N/A	N/A	N/A	94	71	40	43	115
Environmental Metrics	N/A	N/A	N/A	343	273	197	153	219
Total Weighted Index	**N/A**	**N/A**	**N/A**	**233**	**193**	**165**	**132**	**124**

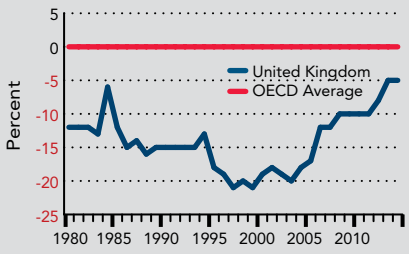
United Kingdom

Energy Security Risk Summary: United Kingdom			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	828	Average Annual Difference 1980-2014	-14%
2014 Large Energy User Group Rank	6	Best Relative Score	-21% (1997)
Score in Previous Year	870	Worst Relative Score	-5% (2014)
Rank in Previous Year	5	**Country-Specific Metric Ranking—2014:**	
Score in 1980	876	Number in Top Five	7
Average Score: 1980-2014	742	Number in Bottom Five	0
Best Energy Security Risk Score	595 (1997)		
Worst Energy Security Risk Score	923 (2011)		

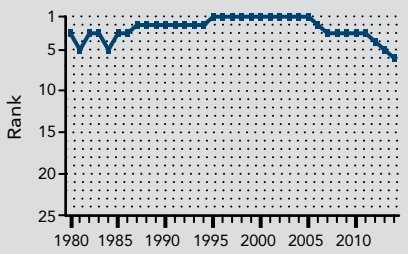
United Kingdom vs. OECD: Risk Index Scores



United Kingdom: Risk Variance from OECD



United Kingdom: Risk Ranking



United Kingdom vs. OECD: Percent Difference (Weighted Within Group)

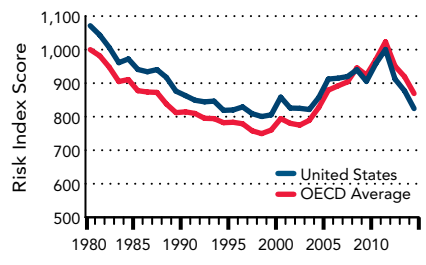
(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-70	-50	-70	-57	-50	-34	-7	24
Energy Expenditure Metrics	12	-2	4	1	0	-1	-1	0
Price & Market Volatility Metrics	1	1	-0	3	-6	-17	-7	-6
Energy Use Intensity Metrics	-20	-18	-18	-24	-28	-31	-35	-37
Electric Power Sector Metrics	32	17	23	6	8	7	13	0
Transportation Sector Metrics	-31	-26	-16	-26	-30	-32	-34	-34
Environmental Metrics	-4	-3	-6	-17	-23	-23	-27	-30
Total Weighted Index	**-12**	**-12**	**-15**	**-18**	**-19**	**-17**	**-10**	**-5**

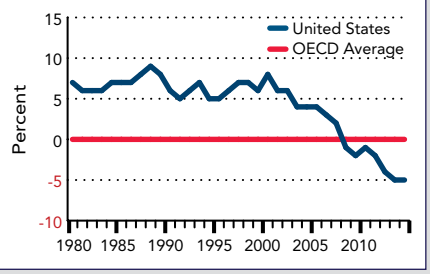
United States

Energy Security Risk Summary: United States			
Risk Scores:		**Risk Scores Relative to OECD Average:**	
2014 Energy Security Risk Score	824	Average Annual Difference 1980-2014	4%
2014 Large Energy User Group Rank	4	Best Relative Score	-5% (2014)
Score in Previous Year	877	Worst Relative Score	9% (1988)
Rank in Previous Year	6	**Country-Specific Metric Ranking—2014:**	
Score in 1980	1,071	Number in Top Five	4
Average Score: 1980-2014	894	Number in Bottom Five	3
Best Energy Security Risk Score	801 (1998)		
Worst Energy Security Risk Score	1,071 (1980)		

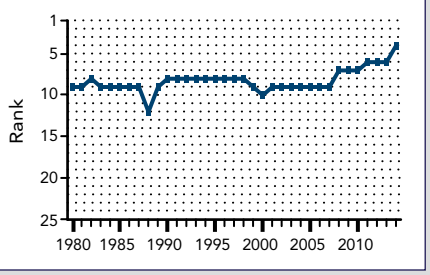
United States vs. OECD: Risk Index Scores



United States: Risk Variance from OECD



United States: Risk Ranking



United States vs. OECD: Percent Difference (Weighted Within Group)

(Red Cells ≥5% Above OECD; Green Cells ≤5% Below OECD; White Cells <5% to <-5% of OCED)

Metric Group	1980	1985	1990	1995	2000	2005	2010	2014
Global Fuels Metrics	0	0	0	0	0	0	0	0
Fuel Import Metrics	-58	-65	-52	-48	-45	-43	-54	-69
Energy Expenditure Metrics	5	19	-1	-15	-2	-3	-10	-9
Price & Market Volatility Metrics	-0	-2	-11	-3	13	-5	-2	-9
Energy Use Intensity Metrics	50	46	49	43	40	37	35	33
Electric Power Sector Metrics	-1	4	1	2	5	7	7	6
Transportation Sector Metrics	93	89	81	75	72	72	67	65
Environmental Metrics	41	38	41	37	36	32	29	26
Total Weighted Index	**7**	**7**	**6**	**5**	**8**	**4**	**-1**	**-5**

Appendix 1: Methodology Used to Develop the Index of U.S. Energy Security Risk

Introduction

In an increasingly interconnected world, where the risks faced by other nations affect our risks as well, a well-designed index covering many countries can improve our understanding of global energy security risks. Many aspects of U.S. energy security are by their very nature global. Recent years have seen global energy markets facing unprecedented challenges as well as opportunities. In previous decades, when the U.S. comprised a bigger share of global energy production and consumption, our policies and actions had a bigger impact on global markets. Increasingly, however, geopolitical risks are imposed upon us rather than set by us.

Energy is a fundamental prerequisite of growth and development around the world, and despite the global financial crisis, energy demand has been steadily growing, especially in the large emerging economies of China, India, and Brazil. In large part, energy security is complicated because key energy resources are geopolitically concentrated. Most of the world's oil and gas reserves are found in a handful of countries, several of which are in political turmoil and/or not especially friendly to U.S. interests. Further, there is relatively little overlap between those countries that are the leading energy resource countries and those that are the major energy consuming countries. Reliance on international trade is large, growing, and vulnerable to disruptions. For these global commodities, events anywhere can affect supply and prices everywhere, even for self-sufficient countries. Energy security risks, therefore, pose challenges to all countries—some are common challenges while others are more country-specific.

An enhanced understanding of energy security in other countries can deepen our insight into that of the U.S. Through the development of these metrics, we can observe not only absolute trends of interest, but to also see relative movement among and across countries. In a global marketplace, both matter.

Communicating these energy security risks to an international audience helps the U.S. as well. Many of the benefits of improved technologies, greater energy efficiency, or democratic reforms anywhere can create energy security benefits everywhere.

Basic Approach to the International Index

The International Index of Energy Security Risk is designed to allow comparisons of energy security risks across countries and country groups, and how these risks change over time. The International Index measures energy security risks in two ways: (1) in absolute terms; and (2) relative to a baseline average of the OECD countries.

The methods used to develop it build off much of the work and concepts used in developing the Energy Institute's Index of U.S. Energy Security Risk® (U.S. Index). The task of boiling down U.S. energy security risks to a single number posed many analytical challenges. The U.S. Index was constructed from a foundation of 37 metrics measuring broad aspects of energy security. The U.S. Index uses historical and forecast data from EIA.

The idea of extending the methodology used in the U.S. Index to other countries proved to be a difficult task, especially when it came to data availability. Accordingly, in developing the International Index, the measures and methodology developed for the U.S. Index had to be adapted.

The United States has a comparative wealth of richly detailed and comprehensive data covering long time spans. The available international databases, however, are something of a mixed bag, and even at their best, they are not as complete and consistent as those we have for the United States. The data typically do not have the historical coverage we have in the United States, and often there are gaps. Data on energy prices and expenditures show gaps in coverage, particularly for non-OECD countries.

Further, whereas the United States has a detailed forecasting system extending decades into the future and dovetails well with historical data, the international forecasts necessarily entail aggregations that prevent the goal of country-by-country analysis.

Data Criteria and Sources

Data limitations make it necessary to strike a balance between the theoretically ideal and the realistically possible. Not every risk metric can be measured with solid data, but that does not mean that less-than-perfect data cannot be used provided its usefulness and limitations are well understood. Even data we commonly view as reliable—U.S. employment, inflation rates, GDP, etc.—are themselves developed from samples and extrapolations, and are best thought of as estimates rather than complete compilations. These issues are magnified when dealing with international data. The approach adopted to develop the International Index was, therefore, not to let the perfect be the enemy of the good.

One of the first tasks in developing the International Index was ensuring that the data being used were useful analytically and would be considered reliable by users of the Index. Before selecting the data, we established criteria to ensure the data used possessed several important characteristics. The criteria settled on are listed in table A1-1:

The primary data source for the International Index is the EIA's International Energy Statistics database, which is in turn compiled from hundreds of documents and data sources. Other key data come from organizations such as the World Bank, IEA, OECD, and others. EIA's database reflects its efforts to compile and curate many disparate sources of information.

Where feasible, data from EIA were preferred over other those from other sources. This allowed for greater consistency in data collection, definitions, country names and changes, *etc.* Where circumstances warranted, EIA's source documents or other sources of information were employed. In particular, energy price data from IEA, transportation and power generation data from the World Bank, and refinery utilization data from British Petroleum were used.

Table A1-1. Data Criteria used for International Index

Sensible	The data must relate to commonsense expectations.
Credible	The data must be well-recognized and authoritative.
Accessible	The data must be readily available to the public.
Transparent	Data derivations and manipulations must be clear.
Complete	The data must have a record extending back in history for a reasonable amount of time (in this case back to 1980)
Updatable	The historical data must be revised each year so that changes over time can be measured.

Another important data series not presented in the EIA database but nonetheless conceptually vital to the International Index is a country-by-country measure of freedom over time. Several metrics related to global reserves and production and imports take into consideration the "freedom" and the diversity of global fuel supplies. Freedom House, an independent nongovernmental organization, has developed composite indices for political rights and civil liberties that when averaged comprise a measure freedom for over 190 countries. The presumption is that countries exhibiting the greatest degree of political rights and civil liberties are more likely to be politically stable and reliable trading partners and are less likely to join cartels or use oil supplies to achieve geopolitical aims. Hence, by weighting each country's reserves or production of oil, natural gas, and coal by its respective Freedom House weighting, we can develop an aggregate global Freedom-weighted metric that provides a proxy for reliability and that can be tracked over time.

Time Dimensions and Geographic Coverage of Metrics

The data limitations discussed above compelled a starting date of 1980, more than sufficient for the purposes of the International Index. Further, because forecast data are not available at the desired level

of detail, the series ends in the most recent year for which data are available.

EIA, IEA, the World Bank, and other sources provide comprehensive, country-by-country information on many measures of energy production, energy consumption, population, GDP, carbon dioxide emissions, and other energy-related measures. Accordingly, for a wide range of energy security risk metrics, time series were developed for all individual countries as well as groups of countries such as the OECD nations. The International Index incorporates the risk index scores for all of the countries globally.

However, differences in geographic coverage also shape the limits of what is possible. Particularly for some of the smaller and/or developing nations, the data are less complete, and it became necessary to develop neutral proxy assumptions and methods for filling in gaps in the historical record. Because of these data limitations, as well as recognition that fewer than 25 of the major economies account for well over half of total world energy consumption, the focus of this published report is aimed at the countries listed below:

1. Australia
2. Brazil
3. Canada
4. China
5. Denmark
6. France
7. Germany
8. India
9. Indonesia
10. Italy
11. Japan
12. Mexico
13. Netherlands
14. New Zealand
15. Norway
16. Poland
17. Russian Federation
18. South Africa
19. South Korea
20. Spain
21. Thailand
22. Turkey
23. Ukraine
24. United Kingdom
25. United States

Metrics of Energy Security Risk

The individual energy security measures selected were organized around eight broad categories that represent and balance some key and often competing aspects of energy security. These are found in table A1-2. Using these categories as guides, 29 individual metrics were developed covering a wide range of energy supplies, energy end uses, generating capacity, operations, and emissions.

In assessing security and risk, the ultimate goal is an improved understanding of the likelihood of an energy shock of some kind and how that might impact a countries economy. However, the data currently available typically describes only what actually happened, not what nearly happened or could have happened. So in this sense, some of the metrics are proxies for things that cannot be measured directly.

As an example, this Index uses measures of political and civil liberties to gauge a country's political stability, and indirectly its reliability as an energy supplier and trading partner. This does not mean that countries that perform poorly in these metrics have been unreliable suppliers in the past or necessarily will be unreliable suppliers in the future. But it does mean the risks of a disruption are higher in countries that do not score well in this metric when compared to countries that do score well.

Recognizing that fuel imports and exports account for a higher share of supply in many countries than they do in the United States, new metrics were created. Coal is an example. The United States has long-term (over 250 years) and secure supplies of coal and risks to supply are largely regulatory in nature, so coal does not feature in the import metrics of the U.S. Index while oil and natural gas do. This is not the case in many other countries that rely on imported coal to meet domestic needs. Therefore, a metric measuring the net import exposure of coal was created in addition to the metrics for oil and natural gas.

Table A1-2. Classification of Energy Security Metrics Used in the International Index	
Metric Category	**General Description of the Metrics**
1. Global Fuels	Measure the reliability and diversity of global reserves and supplies of oil, natural gas, and coal. Higher reliability and diversity mean a lower risk to energy security.
2. Fuel Imports	Measure the exposure of the national economies to unreliable and concentrated supplies of oil and natural gas, and coal. Higher supply reliability and diversity and lower import levels mean a lower risk to energy security.
3. Energy Expenditures	Measure the magnitude of energy costs to national economies and the exposure of consumers to price shocks. Lower costs and exposure mean a lower risk to energy security.
4. Price & Market Volatility	Measure the susceptibility of national economies to large swings in energy prices. Lower volatility means a lower risk to energy security.
5. Energy Use Intensity	Measure energy use in relation to population and economic output. Lower use of energy by industry to produce goods and services means a lower risk to energy security.
6. Electric Power Sector	Measure indirectly the reliability of electricity generating capacity. Higher diversity means a lower risk to energy security.
7. Transportation Sector	Measure efficiency of energy use in the transport sector per unit of GDP and population. Greater efficiency means a lower risk to energy security.
8. Environmental	Measure the exposure of national economies to national and international greenhouse gas emission reduction mandates. Lower emissions of carbon dioxide from energy mean a lower risk to energy security.

These fuel-specific measures, however, do not do a good job of indicating how important that fuel is in the overall energy mix of the country. Consider two countries that meet most of their demand for a particular fuel, say natural gas, through imports. If in one of these countries gas is a relatively small part of the energy mix and in the other gas is a very large part of the energy mix, their level of risk is quite different. To help account for these broader dependencies as well as the fuel-specific concerns, a metric measuring total energy import exposure is used to reflect the diversity of the different fuel mix in the country. This metric helps even out the effects of outlying values for individual fuels and picks up nuclear and renewable energies.

Energy price and expenditure data are very important measures of certain aspects of energy security, but the availability and quality of these data varies greatly and overall there is much less coverage of prices by sector and fuel than there is in the United States. As a result, the focus of the International Index is on overall energy prices rather than sector-level or end-use prices.

The primary source of energy price and expenditure data for the International Index is the IEA. Given IEA's mission and origins, it is not surprising that the amount and extent of price data for OECD countries is much greater than it is for non-OECD countries, but even the coverage in many OECD countries is less than ideal. To include energy price and expenditure metrics in the International Index, proxies had to be developed for energy prices for countries where IEA data were incomplete or unavailable. Using IEA price and consumption data for different fuels, we developed rough approximations of energy prices and expenditures that, while imperfect, meet the needs of the International Index.

Given all of these considerations, 29 metrics were developed for use in the International Index. These are listed and described in figure A1-3.

Normalizing the Metrics into Indexes

The International Index provides an understanding of the absolute trends in energy security risks in selected countries and the relative trends vis-à-vis to other countries. Tracking a country's relative progress in this way can provide insights into market conditions, policies, and other events affecting energy security at a national level.

The various metrics used in the index are measured in many different units making it necessary to transform them into comparable "building blocks" that could then be assembled into an index.

Table A1-3. Metrics Used to Create International Index of Energy Security Risk				
Metric by Classification		Definition	Importance	Weight (Percent)
Global Fuel Metrics				**14**
1.	Security of World Oil Reserves	Global proved oil reserves weighted by each country's relative Freedom Index and by an index of global diversity of oil reserves.	Indicates risk attached to the average barrel of global crude oil reserves. As a measure of reserves, it largely reflects longer-term concerns.	2
2.	Security of World Oil Production	Global oil production weighted by each country's relative Freedom Index and by an index of global diversity of oil production.	Indicates the level of risk attached to the average barrel of crude oil production globally.	3
3.	Security of World Natural Gas Reserves	Global proved natural gas reserves weighted by each country's relative Freedom Index and by an index of global diversity of gas reserves.	Indicates the risk attached to the average cubic foot of natural gas reserves globally. As a measure of reserves, it largely reflects longer-term concerns.	2
4.	Security of World Natural Gas Production	Global natural gas production weighted by each country's Freedom Index and by global diversity of gas production.	Indicates the level of risk attached to the average cubic foot of natural gas production globally.	3
5.	Security of World Coal Reserves	Global proved coal reserves weighted by each country's relative Freedom Index and by an index of global diversity of coal reserves.	Indicates the risk attached to the average ton of coal reserves globally. As a measure of reserves, it largely reflects longer-term concerns.	2
6.	Security of World Coal Production	Global coal production weighted by each country's relative Freedom Index and by an index of global diversity of coal production.	Indicates the level of risk attached to the average ton of coal production globally.	2
Fuel Import Metrics				**17**
7.	Petroleum Import Exposure	Net petroleum imports as a percentage of total national petroleum supply, adjusted to reflect the reliability of international petroleum production (measured using the Freedom Index) and the diversity across producing countries.	Indicates the degree to which changes in import levels expose the country to potentially unreliable and/or concentrated supplies of crude and refined petroleum.	3
8.	Natural Gas Import Exposure	Net natural gas imports as a percentage of total national gas supply, adjusted to reflect the reliability of international gas production (measured using the Freedom Index) and the diversity across producing countries.	Indicates the degree to which changes in import levels expose the country to potentially unreliable and/or concentrated supplies of natural gas.	3
9.	Coal Import Exposure	Net coal imports as a percentage of total national coal supply, adjusted to reflect the reliability of international coal production (measured using the Freedom Index) and the diversity across producing countries.	Indicates the degree to which changes in import levels expose the country to potentially unreliable and/or concentrated supplies of coal.	2

Table A1-3. Metrics Used to Create International Index of Energy Security Risk				
Metric by Classification		Definition	Importance	Weight (Percent)
10.	Total Energy Import Exposure	Net energy imports as a share of total primary energy consumption.	Indicates the degree to the country is reliant on foreign sources for it energy needs.	4
11.	Fossil Fuel Import Expenditures per GDP	Net fossil fuel import costs as a share of GDP.	Indicates the susceptibility of a country to imported fossil fuel price shocks.	5
Energy Expenditure Metrics				**20**
12.	Energy Expenditure Intensity	Total real cost of energy consumed per real $1,000 USD of GDP per year.	Indicates the magnitude of energy costs in the economy to energy price shocks, and exposure to price changes.	4
13.	Energy Expenditures per Capita	Total real dollar cost of the energy consumed per person per year.	Indicates the importance of energy in personal budgets and the susceptibility of households to energy price shocks.	3
14.	Retail Electricity Prices	Average electricity costs in real cents per kWh.	Indicates the availability of low-cost, reliable forms of power generation.	6
15.	Crude Oil Prices	Real cost per barrel of crude oil.	Indicates the susceptibility of the economy to high prices for petroleum, which supplies a significant portion of national energy demand.	7
Price & Market Volatility Metrics				**15**
16.	Crude Oil Price Volatility	Annual change in crude oil prices, averaged over a three-year period.	Indicates the susceptibility of the economy to large swings in the price of petroleum.	5
17.	Energy Expenditure Volatility	Average annual change in energy expenditures per $1,000 USD of GDP.	Indicates the susceptibility of the economy to large swings in expenditures for all forms of energy.	4
18.	World Oil Refinery Utilization	Average percent utilization of global petroleum refinery capacity.	Indicates the likelihood of higher prices at high capacity utilization, and higher risk of supply limitations during refinery outages or disruptions.	2
19.	GDP per Capita	Total real dollar GDP per person per year.	Indicates the importance of wealth and productivity to the ability to innovate and respond to energy shocks.	4

Table A1-3. Metrics Used to Create International Index of Energy Security Risk

Metric by Classification		Definition	Importance	Weight (Percent)
Energy Use Intensity Metrics				**14**
20.	Energy Consumption per Capita	Million British thermal units (Btu) consumed per person per year.	Indicates changes in both energy intensity and in per-capita GDP and importance of energy to individuals.	4
21.	Energy Intensity	Million Btu of primary energy used in the domestic economy per $1,000 USD of real GDP.	Indicates the importance of energy as a component of economic growth.	7
22.	Petroleum Intensity	Million Btu of petroleum consumed per $1,000 USD of real GDP.	Indicates the importance of petroleum as a component of economic growth.	3
Electric Power Sector Metrics				**7**
23.	Electricity Diversity	Average of market share concentration indexes (HHI) of: (1) the primary categories of electric power generating capacity, adjusted for availability; and (2) primary categories of electric power generation.	Indicates the flexibility of the power sector and its ability to dispatch electricity from a diverse range of sources.	5
24.	Non-CO_2 Emitting Share of Electricity Generation	Percentage of total electric power generation contributed by renewables, hydroelectric, nuclear and fossil-fired plants operating with carbon capture and storage technology.	Indicates the degree to which the power sector is employing non-CO_2 emitting generation.	2
Transportation Sector Metrics				**7**
25.	Transportation Energy per Capita	Million Btu consumed in the transportation sector per person per year.	Indicates changes in both transportation energy intensity and in per-capita GDP and importance of transportation energy to individuals.	3
26.	Transportation Energy Intensity	Million Btu of primary energy used in the transportation sector per $1,000 USD of real GDP.	Indicates the importance of energy used in transportation as a component of economic growth.	4
Environmental Metrics				**6**
27.	CO_2 Emissions Trend	Annual change in total national energy-related CO_2 emissions.	Indicates the exposure of the economy to domestic and international emissions reduction mandates.	2
28.	Energy-Related Carbon Dioxide Emissions per Capita	Metric tons of CO_2 emissions (energy-related), per capita.	Indicates the joint effect of the amount of energy used per capita, and the carbon intensity of that energy use.	2
29.	Energy-Related Carbon Dioxide Emissions Intensity	Metric tons of CO_2 per $1,000 USD of real GDP.	Indicates the importance of carbon-based fuels as a component of the economy.	2

For the International Index to convey information about both changes in energy security risk within a country over time and changes in risk compared to other countries over time, an international benchmark against which the individual countries could be compared had to be created. For this, we selected the average of the present roster of OECD nations.

As a group, the OECD countries provide a good reference measure, with broad coverage across a range of developed nations. Importantly, data for the OECD nations generally are timely, complete, and wide-ranging, which enable an OECD-wide value for all of our metrics.

To set the OECD baseline, each of the 29 metric was normalized so that the value for 1980 equaled 1,000. For subsequent years, the indexed value for each metric was adjusted proportionally higher or lower relative to this 1980 value.

The country-level metrics were normalized by calibrating their 1980 values in reference to the common OECD 1980 baseline. If, for example, a country's 1980 value in energy intensity was 17% higher than the OECD average value for that metric, the 1980 value for that metric would be set at 1,170. Normalized metric scores for subsequent years would rise or fall relative to that starting point. In this way, both a country's relative performance against the OECD average and its absolute performance can be measured for each metric.

Weighing the Metric Indexes

The 29 normalized metrics produced for each country from the procedure described above were combined to produce an overall risk score for each country that represents their weighted average.

The weighing of the 29 International metrics began with placing them into eight logical groupings. Each of the categories includes at least two and no more than six metrics (Table A1-3).

For weighting the metrics, the approximate weights of each metric category in the U.S. Index were assigned these categories in the International Index (Table A1-4). Fuel Imports were given a greater weighting in the International Index, and a lack of reliable and current data meant that no R&D metrics were used. Next, weights were allocated to the individual metrics based on weight of the category to which it belongs and, where possible, its relative importance within that category.

Table A1-4. Input Weights by Metric Category

Category	U.S, Index Weightings	International Index Weightings
Global Fuels	15.1	14
Fuel Imports	11.8	17
Energy Expenditures	18.3	20
Price & Market Volatility	12.6	15
Energy Use Intensity	15.3	14
Electric Power Sector	6.2	7
Transportations Sector	9.8	7
Environmental	7.6	6
R&D	3.3	NA

Using these steps, we were able to construct an energy security risk index for each country, as well as for the OECD. For each country, there are 29 metrics, each with a time series value that has been normalized into a risk measure where the OECD 1980 value is set to 1,000. For each country and each year, the 29 metrics are weighted according to the values shown in Table A1-3. The risk index for a country in any given year is then the sum of the metric values, each multiplied by its assigned weighted share.[21] Using this logic, the OECD reference group, where each metric was normalized so that 1980 equals 1,000, therefore will have a 1980 total value of 1,000.

Appendix 2: Data Sources

The Energy Institute relied primarily on government data from the Energy Information Administration and the International Energy Agency to develop its International Index of Energy Security Risk. Where historical data from government sources were not available, other widely-used and respected sources were employed. The following provides a list of the main sources of the data used to compile the metrics.

BP: *BP Statistical Review of World Energy*. Available at: http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html. For refinery capacity and utilization data.

Energy Information Administration:

- International Energy Statistics. Available at: http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm. For historical international energy production, consumption, reserve, import, export, electricity capacity, and other energy data.

- *Annual Energy Review*. Available at: http://www.eia.doe.gov/emeu/aer/contents.html. For crude oil price data.

Freedom House: *Freedom in the World: Comparative and Historical Data*. Available at: http://www.freedomhouse.org/report-types/freedom-world. For historical international political rights and civil liberties data. Freedom House's annual index of political rights and civil liberties was used as a proxy for reliability of international trading partners.

International Energy Agency: IEA Statistics, *Energy Prices and Taxes*. Available at: http://www.iea.org/stats/index.asp. Subscription required. For energy price and expenditure data.

World Bank: Development Indicators. Available at: http://data.worldbank.org/indicator/all. For population, gross domestic product, net energy imports, electricity generation by energy source, and transport energy.

Institute for 21st Century Energy
U.S. Chamber of Commerce
1615 H Street, NW
Washington, DC 20062
Phone: (202) 463-5558 Fax: (202) 887-3457
energyinstitute@uschamber.com
www.energyxxi.org

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