INTERNATIONAL INDEX OF ENERGY SECURITY RISK®

ASSESSING RISK IN A GLOBAL ENERGY MARKET

2013 Edition

Institute for 21st Century Energy • U.S. Chamber of Commerce

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

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Foreword

Last year's inaugural edition of the Institute for 21st Century Energy's *International Index of Energy Security Risk* was the first comprehensive comparative analysis of the energy security risks confronting the United States and 24 other large energy consuming countries from 1980 to 2010. This second edition incorporates the addition of a new metric, methodological improvements, and revised data through 2012 to provide a more relevant and timely picture of these risks.[1]

Energy is a fundamental prerequisite of growth and development around the world. Energy use surely poses risks, but it also delivers many rewards. Increasing use of affordable energy is associated with a whole range of positive social and economic outcomes, including improved health, longer life expectancy, growing income, increased penetration of information technologies, cleaner drinking water, higher educational attainment, greater mobility, and many others. Of course, it is not energy consumption *per* se that confers these benefits, but the end-use services that energy makes possible. Greater wealth reduces risks by increasing the capability of countries to weather energy disruptions and market volatility.

These considerations are especially important in a comparative analysis of energy security across 25 countries with very different levels of economic attainment. To capture this idea that energy resilience also stems in part from economic advancement, this 2013 edition of the International Index incorporates per capita gross domestic product as a new metric.

Despite the global financial crisis, energy demand has continued to grow steadily, especially in the large emerging economies of China, India, and Brazil. The International Energy Agency (IEA) estimates that well over a billion people still lack access to modern energy services, and providing these energy services is a priority for many governments around the world aiming to lift people out of poverty.

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 not especially friendly to U.S. interests. But that could be changing.

Further, there is relatively little overlap between those countries that have the most resources and those that consume the most energy. 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.

While the International Index reflects measures applied to all countries equally, it is also important to recognize that the energy security challenges each county faces can be quite different based on a number of factors, many of which cannot be controlled. It is clear that in most cases countries seek to capitalize on their comparative advantages as they cope with comparative disadvantages.

The first (2012) edition of the International Index measured energy security risks through 2010. In this year's edition, it runs through 2012. A lot has happened in the intervening two years, both good and bad, to influence the results.

Two items stand out in particular: the growth of unconventional oil and natural gas output in the United States and Canada and the Fukushima Daiichi nuclear incident in Japan. Both could have longer-term implications.

Through the application of new technologies, North America is moving from an era of energy resource scarcity to one marked by energy abundance. Many experts now believe energy self-reliance for North America, perhaps even for the United States alone, actually may be within reach in the coming decade. Simply put: the world's

energy center of gravity is shifting from the Middle East to North America, with possibly profound economic and geopolitical implications.

In 2002, North American proved reserves accounted for about 5% of the world total. The following year, the addition of 175 billion barrels of oil from Canada's oil sands to proved reserves boosted North America's reserves to 215 billion barrels and its share of proved global reserves to 18%. In a recent report, EIA estimates that in 2013—10 years later—technically recoverable resources of unproved conventional and shale oil resources could be as high as 594 billion barrels, triple the 2003 estimate. Rapidly improving technology could send this estimate higher. When combined with the estimated 2 trillion barrels of U.S. oil shale and oil sand resources, North America's crude oil resource potentially is greater than the amount of proved conventional reserves in the rest of the world today.

Canada has doubled its oil production over the last two decades, and future increases are expected. Production from the Alberta oil sands can increase from the current 1.4 million barrels per day (MMbbl/d) to more than 3.5 MMbbl/d by 2025, perhaps more. Today, almost all of Canada's oil exports are to the United States. The Keystone XL pipeline project, which is being delayed for lack of presidential approval, would provide U.S. Gulf Coast refineries with improved access to this secure, reliable, and growing supply of crude oil. New infrastructure outlets connecting Alberta's oil fields to Canada's East and West coasts also are being planned to diversify export outlets and ensure markets for Canada's burgeoning crude oil production..

According to the Energy Information Administration (EIA), petroleum fuels will remain the largest energy source worldwide for decades into the future. As the global economy recovers and developing economies continue to rapidly expand, demand for energy will increase by as much at 56% by 2040, and competition for petroleum and all forms of energy will increase throughout the world. As a result, increasing US imports from Canada will further displace overseas imports and have tremendous economic and national security benefits.

U.S. unconventional natural gas production also has a very large regional impact that could eventually be felt globally. According to EIA, U.S. shale gas resources are among the largest in the world, and new drilling and seismic imaging technologies are unlocking vast stores of this fuel. Unlike most every other region of the world, the link between the price of natural gas and the price of crude oil in the United States has been severed, with the price of natural gas now being set by supply and demand fundamentals. As a result, natural gas prices in the United States are much lower than in the rest of the world. Affordable natural gas confers a tremendous competitive advantage to the United States. By 2020, the United States will be a net exporter of natural gas rather than a large net importer.

Other countries are responding to these shale developments in various ways. Mexico, for example, is considering changing its constitution to allow foreign investment in oil and natural gas production, undoubtedly prompted by what is going on north of its border. China is seriously pursuing shale gas development. The response in Europe has been mixed, with some countries moving ahead cautiously while others prefer to leave these resources untouched, at least for the time being. Russia has very large shale gas resources, but lacks the capacity to tap into them.

There are questions as to whether other countries can repeat the U.S. shale experience. The United States has many advantages: homegrown technology;, extensive infrastructure; favorable geology; and landowners that possess mineral rights, making them partners in the enterprise. Many of these conditions do not exist overseas, so it will be interesting to see how other countries approach these and other factors once the decision is made to develop large shale oil and gas resources many of them have.

The Japanese government's response to the Fukushima Daiichi nuclear incident in March 2011 had an almost immediate impact on that country's energy security risk. Japan invested heavily in nuclear power to insulate the country from unreliable supplies of imported fossil fuels. Before the incident, its 54 reactors accounted for about 25% to 30% of electricity generation. By 2012, all but two of the country's 54 nuclear reactors had been shut down.

These events not only increased the energy risks for Japan in 2012, they also have caused other countries to reconsider their nuclear programs. Many countries, including China, for example, delayed moving ahead with projects to undertake safety reviews. The incident caused Germany to change its policy and close down all of its nuclear reactors by 2022. Whether or not other countries follow suit remains to be seen, but nuclear power's future is considerably different after Fukushima.

Longer-term trends also are exerting a growing influence. The rapidly changing marketplace for crude oil is one. Crude oil is a global commodity whose price is set in the global marketplace, and its price is a key risk factor. Whereas developed countries historically have been largest sources of oil demand, greater efficiency measures and fuel substitution in the United States and other developed countries is flattening demand growth. The U.S. Energy Information Administration (EIA) forecasts that virtually all of the increase in oil demand out to 2040 is expected to come from emerging economies, most notably China.

Something similar is happening in crude oil production. Much greater unconventional output in the United States and Canada will only just offset lower output from the North Sea and elsewhere, which means that the other OECD countries will show an overall decline in production. Most of the increase in output is from non-OECD countries, particularly OPEC members and Brazil.

The increasing role by non-OECD producers and consumers in oil markets means options for managing crude oil price and volatility risks become more limited, which increases the importance of U.S. and Canadian production and fuel efficiency and fuel flexibility gains.

Another long-term trend is the strong demand for coal in developing countries, especially in Asia. As developing countries seek to increase access to electricity for their people, many are turning to coal as the fuel of choice. It is abundant, affordable, and is readily available in many countries. Demand in developing countries is expected to grow by nearly three-quarters by 2040. The International Energy Agency believes that before 2020, coal will overtake oil as the world's largest source of energy. Greater coal use, particularly in countries where natural gas is is expensive and in short supply, will help lead more people out of energy poverty.

One final point: Energy is becoming an ever more critical competitive factor for many countries. The shale revolution in the United States has lowered the price of natural gas and, combined with the already affordable price of coal, gives the United States a large advantage vis-à-vis Europe and Japan. The European Commission found that from 2005 to 2012, while Japan's electricity rates climbed 20% and Europe's rates 40%, U.S. rates declined about 5%. U.S. electricity rates are now about three to five times lower than European rates. Much of the difference is down to energy policy as much as resources. The United States can choose to retain this edge, or squander it. The choice is ours.

How the United Sates and the other countries featured in this report grapple with these and many other complex issues will determine whether their energy security risks rise or fall. One thing we can say with confidence is that energy security will remain a primary concern of governments worldwide. The International Index can help make sense of the transitions underway in global energy markets.

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

Acknowledgements

Developing the International Index has been a very complex and lengthy undertaking that 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 executing the international database of energy security metrics that is the heart of the Index. Energy Institute intern Clinton Willbanks also played a big role in gathering and assessing the data and in developing some of the metric revisions used in this report. A huge debt of gratitude is also due to the entire production team here at the U.S. Chamber of Commerce, led by Brian Miller, for designing and producing the publication under a tight deadline. Finally, special thanks go to the entire Energy Institute team for creating an index that is changing the way the we look at energy security.

Highlights

This second 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 2012. The risk index calculates scores for the United States and 24 other countries that make up the large energy user group: Australia, Brazil, Canada, China, Denmark, France, Germany, India, Indonesia, Italy, Japan, Mexico, Netherlands, New Zealand, 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 a reference index representing the average risks for Organization for Economic Co-operation and Development (OECD) member countries.[2] The OECD average risk index is calibrated to a 1980 base year figure of 1,000. This calibration enables us to track changes across countries as well as countries across time. Keep in mind that a higher score means higher risk, a lower score means lower risk.

Please note that the addition of a new metric (GDP per capita), changes to an existing metric, new metric weightings, and revisions to historical and estimated data mean that the results reported in last year's edition will be slightly different than in this year's edition.

2012 Energy Security Rankings

Table H-1 shows how energy security risks in 25 large energy-consuming countries compare against each other and the OECD average in 2012. The rankings in the table are analogous to the leader-board at a golf tournament where the highest (best) rank has the lowest numerical risk score and the lowest (worst) rank the highest numerical risk score.

Norway was the most energy secure country in the large energy user group in 2012 and has been since 2001. It's total risk score of 909 was 14% below the OECD average score of 1,051. Mexico was the second ranked country with a score of 928.

For the entire period from 1980 to 2012, either Norway or Mexico has occupied the top spot except for 1997, when the United Kingdom was ranked number one. Mexico's risk scores, however, continue to rise faster than the OECD baseline average. If this trend persists, the country's ranking would slide in future years. New Zealand, the United Kingdom, and Canada round out the top five for 2012.

The Ukraine was least energy secure country in the large energy user group. With a 2012 score of 2,250, its overall risk was 114% above the OECD average. It has not moved out of the 25th spot since 1992, the first year data for the country became available. Nevertheless, the Ukraine is one of the few countries that has seen its energy security risk score decline since the mid- to late-1990s, both absolutely and relative to the OECD baseline average (from 296% above the OECD average in 1996 to 114% above in 2012). The country's scores are still so high, however, that much greater progress will be needed for the Ukraine is to break out of the bottom position. Thailand, South Korea, the Netherlands, and India make up the rest of the bottom five.

The United States climbed one place in 2012 and now ranks as the sixth most energy secure country in the group. With a 2012 score of 999, its energy security risk was about 5% below the OECD average. The revolution in domestic unconventional oil and natural gas output in the United States was the biggest factor in the country's move up the rankings. Since 2002, when it came in at number 10, the United States has climbed four places.

Table H-1. Energy Security Risk Scores and Rankings for 25 Large Energy Using Countries: 2012		
Country	**Risk Score**	**Large Energy User Group Rank**
Norway	909	1
Mexico	928	2
New Zealand	955	3
United Kingdom	973	4
Canada	987	5
United States	999	6
Australia	1,000	7
Denmark	1,024	8
Germany	1,047	9
OECD	1,051	
France	1,088	10
Poland	1,101	11
Indonesia	1,127	12
Spain	1,173	13
Russia	1,176	14
Turkey	1,194	15
South Africa	1,207	16
Italy	1,208	17
Japan	1,219	18
China	1,228	19
Brazil	1,231	20
India	1,237	21
Netherlands	1,312	22
South Korea	1,514	23
Thailand	1,559	24
Ukraine	2,250	25

Key Developments

Energy security risks for all countries in the large energy user group and for the OECD average fell in 2012, primarily because of lower energy prices and expenditure volatility. This follows two consecutive years, 2010 and 2011, in which risks for all countries rose. The biggest drivers for the reduction in risk in 2012 were the large reductions in metrics measuring crude oil volatility and energy expenditure volatility. Because crude oil is priced in a global market, the 27% decline in crude oil price volatility benefited everyone about equally. As expenditures on oil make up a big part total energy expenditures, the volatility for this metric for this metric also improved in every country, though its impact in each country was more variable, depending on the share of oil in the energy mix.

The benefits of greater unconventional oil and natural gas production from oil sands and shale formations in North America are beginning to be seen. Lower oil and gas import supply and expenditure risks have contributed to lower overall risk scores for Canada and the United States. In 2012, both of these countries moved up one place in the rankings, to five and six, respectively.

Additional U.S. oil output of 815,000 barrels and Canadian output of 235,000 barrels per day in 2012 kept the world oil supply risks lower than they would have otherwise been the case. Increased production from stable suppliers reduces global reliance on supplies from more unstable parts of the world. Moreover, the increase in oil output from the United States alone in 2012 was more than enough to offset the decline in oil output from Iran (687,000 barrels per day), whose oil production is under international export sanctions. Greater output from North America will become an even more important factor moderating risks as output from the North Sea declines.

Expanded U.S. production natural gas from shale formations is lowering global supply risks. Gas import risks remain very high for many countries, especially in Europe and Asia. It is now expected that by 2020, the United States will be a net exporter of natural gas. This is already having an impact on overseas markets, where shipments once destined for the United States are being diverted to European and other markets. Japan, too, is looking at U.S. natural gas as a reliable source of energy as it considers the future of its nuclear plants. Other countries also are looking to expand natural gas, so it is important that the federal government quickly approve applications to export of liquefied natural gas (LNG) if the U.S. is to establish a presence in global natural gas markets.

Low retail electricity prices in coal- and natural gas-rich countries such as Australia, Canada, and the United States have made them comparatively more energy secure and competitive. Electricity prices in much of Western Europe and Japan have increased sharply in recent years and are now among the highest in the world. This in turn creates competitive pressures, especially on energy-intensive industries. The use of affordable coal and, increasingly, natural gas for power production in North America and Australia has kept electricity prices comparatively low. Large-scale hydropower, especially in Canada, also has contributed to lower electricity prices.

Even as Japan's overall energy security benefited from lower energy expenditure volatility (like for others countries), the deep drop in electric power generation from nuclear facilities in 2012, a reaction to the Fukushima Daiichi nuclear incident in March 2011, worsened that country's energy security relative to other countries in the large energy user group. By March 2012, all but two of the country's 54 nuclear reactors had been shut down, and under public pressure, they remained closed for the remainder of the year. As a result, Japan faced growing risks related to energy imports and expenditures, reduced power sector diversity, non-carbon generation, and price volatility, all of which contributed to Japan falling from an already low rank of 14 in 2011 to 18 in 2012. The accident also prompted rethinking about nuclear power in other countries, with the German government deciding to shut down all of its nuclear capacity by 2022.

Historical Trends in International Energy Security Risks: 1980-2012:

The time trend of the OECD risk scores and many other countries in the large energy users group resembles a shallow U-shaped trough, with high risks but declining risks after 1980, comparatively low risks in the 1990s, and rising risks through the 2000s (Figure H-1). From a score of 1,000 in 1980, average OECD energy security risks fell steadily to 766 in 1998, after which risks rose steadily, reaching their highest level of 1,125 in 2011 before retreating to 1,051 in 2012. The declining risk from 1980 to the mid 1990s reflected lower risk scores in 22 of the 29 individual risk metrics. Rising rise scores from 1998 to 2012 were almost as broad-based, with 16 metrics getting worse and 13 showing improvement. Risks associated with import exposure, the reliability and diversity of fossil energy supplies worldwide, and energy prices, volatility, and expenditures all contributed to rising risks over this period. Metrics measuring energy intensity, petroleum intensity, GDP per capita, and transport energy intensity risks improved consistently throughout the entire 33-year period.

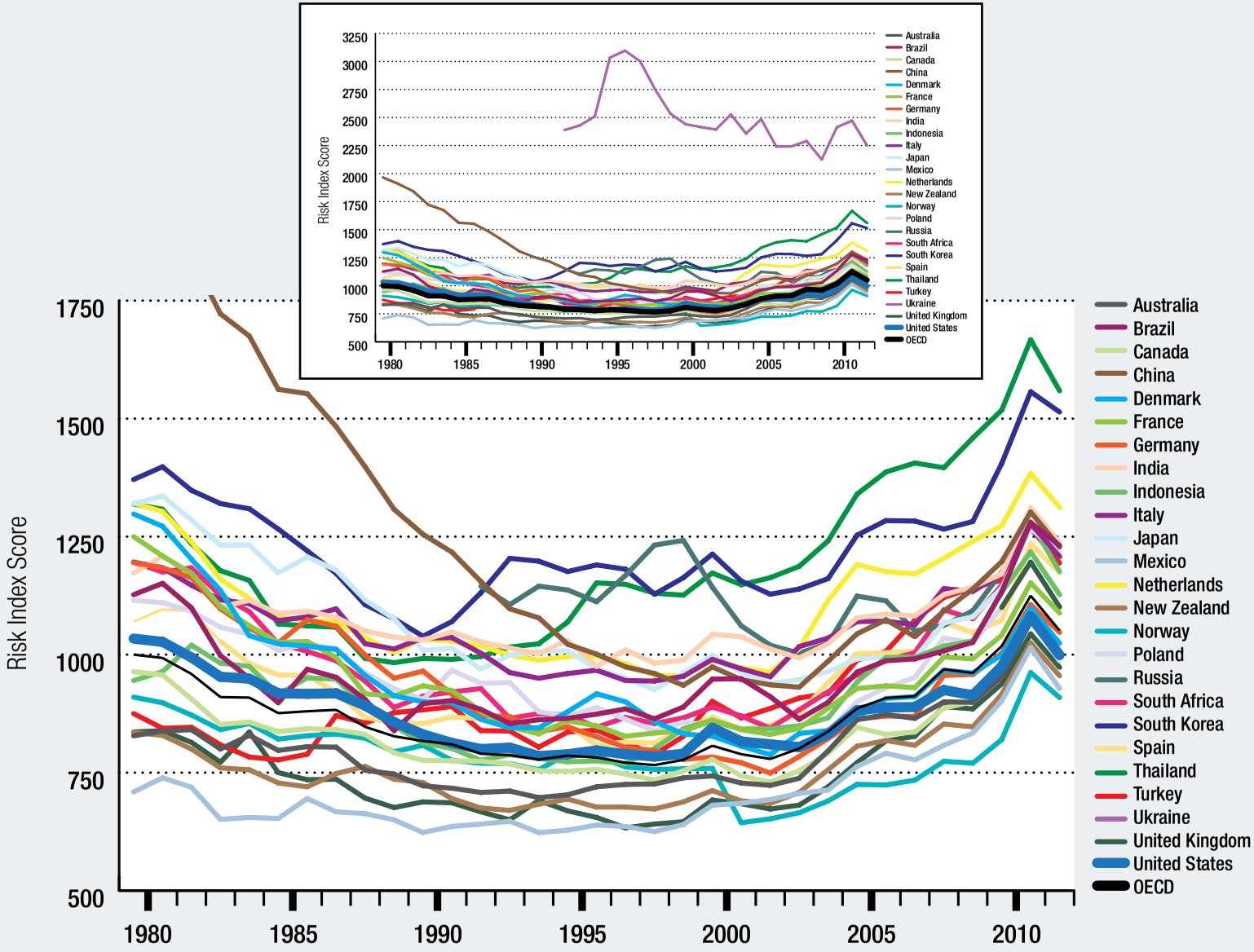
The dip in overall energy security risk in 2012 interrupted a general trend of rising risks since 2000 or so for most countries in the large energy user group. Of the 23 countries in the large energy user group in existence since 1980, 14 have higher total energy security risks in 2012 than they did in 1980, a year of extraordinarily high risk.[3] The United States is among the nine countries with lower risk scores in 2012 than in 1980.

The decade of the 1990s was the best for energy security risks. Of the 23 countries in the large energy user group in existence in 1980, 13 had their best risk score somewhere between 1990 and 1999. For the United States, it was 1998.[4]

The disparities in risk between the countries in the large energy user group and the OECD average have narrowed even as overall risks have risen. If the Russian Federation and the Ukraine are removed from consideration (because no data are available for these two countries until 1992), the spread between the highest and lowest risk scores has dropped from 1,257 in 1980 to 651 points in 2012, and the average absolute departure from the OECD average has declined from 22% to 14%. This means the disparities in risk among the countries in the large energy user group generally have been getting smaller even as overall risks have been rising.

A large energy resource base does not guarantee a high energy security ranking, and a small resource base does not guarantee a low ranking. Table H-2 ranks energy security risks from the most secure to the least secure—that is, from best to worst—revealing a broad range of energy security risks among the countries in the large energy user group. Trends in country rankings have been 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

Figure H-1. Energy Security Risk Index Scores for Large Energy User Group: 1980-2012



base, stage of economic development, population density, climate, and others; (3) technology innovation and adoption; and (4) energy policies. Some countries, such as Mexico, United Kingdom, and Australia, consistently have had very good risk rankings for almost the entire period since 1980. Other countries, like Denmark, Norway, and the United States, have improved their rankings greatly over the years, while others—notably China—improved only to slip back down the list. Still others, such as India and Turkey, have seen their rankings go from good to bad over the years, and some, such as Brazil, the Netherlands, and South Korea, have seen their ranking go from bad to worse.

For many emerging economies like China, India, South Africa, and Turkey, rapid economic growth since around 2000 has exacerbated underlying energy security risks. Even Mexico, a country with some of the best scores historically, has seen over many years its dominant position weaken relative to other countries. Rising industrialization and growing middle classes in these countries has tended to increase energy intensity and energy use per capita, increasing demand and squeezing energy supplies. It is anticipated that continued economic growth will increase energy efficiency and allow greater investment in energy exploration and production and infrastructure, which will put downward pressure on energy risks. Moreover, as these countries increase in wealth creation, they will be better situated to make capital investments in expanding and improving energy infrastructure and to deal with energy shocks.

Table H-2. Energy Security Rankings for Large Energy User Group: 1980-2012

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

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 its risks compare to the OECD average and those factors that have had the greatest impacts, both positively and negatively, on their energy security. The countries are listed in alphabetical order.

Each country summary also includes the following:

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 energy security risk data for each country are presented in Appendix 3.).

2. A chart showing the energy security risk scores for that country and the OECD since 1980.

3. A chart showing the variance, measured as a percent, in that country's risk scores compared to the OECD average since 1980. This provides an indication or progress or deterioration in energy security risks compared to the OECD baseline average.

4. A chart showing that country's risk ranking since 1980.

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 any one year to the next and place more emphasis on broader trends within and across countries, as this latter perspective is more suited to the available data.

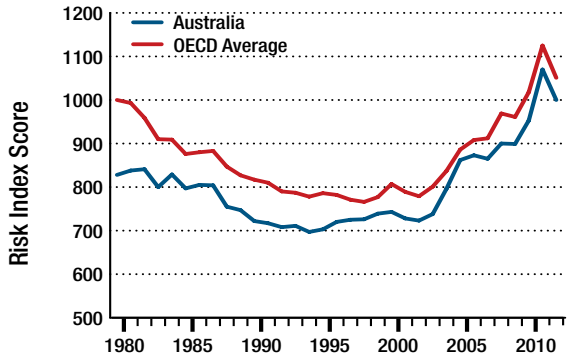
More country level data and information are available at the EIA website at http://www.eia.gov/countries/.

AUSTRALIA

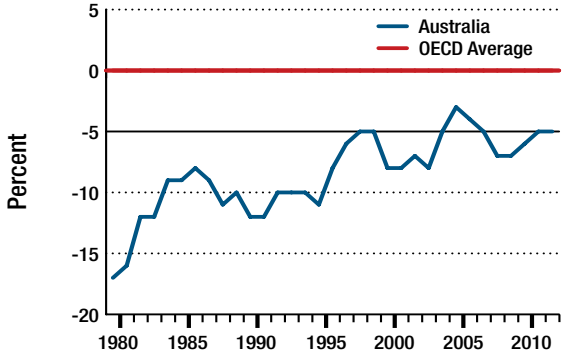
Energy Security Risk Summary: Australia

Risk Scores:	
2012 Energy Security Risk Score	1,000
2012 Large Energy User Group Rank	7
Score in Previous Year	1,070
Rank in Previous Year	5
Score in 1980	828
Average Score: 1980-2012	799
Best Energy Security Risk Score	697 (1994)
Worst Energy Security Risk Score	1,070 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	-8%
Best Relative Score	-17% (1980)
Worst Relative Score	-3% (2005)

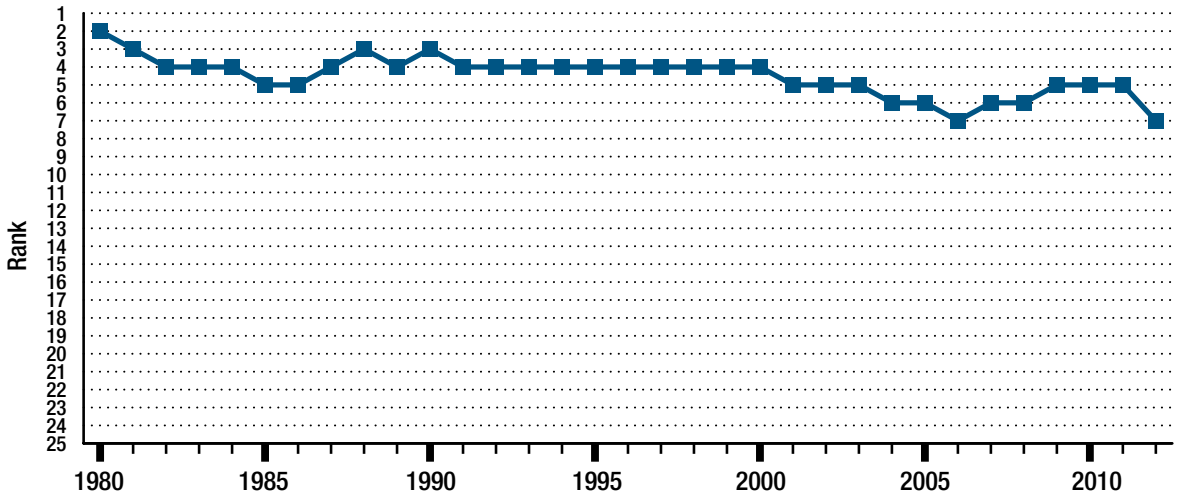
Australia vs. OECD: Risk Index Scores



Australia: Risk Variance from OECD



Australia: Risk Ranking



Australia's 2012 energy security risk score of 1,000—at just 1 point higher, virtually tied with the United States—earned it a number seven ranking, a drop of two places from 2011. Australia's improvement in energy price volatility risk was much less than that experienced by its peers, and that primarily explains the slip in it ranking. Nevertheless, with an average rank of 4.5, Australia's scores consistently have been in the top 10 of the large energy users group, fluctuating between seven and two.

Australia is rich in energy resources, particularly coal and natural gas, which it exports in large quantities. It is the world's largest exporter of coal and fourth largest exporter of LNG. As a result, its import exposure risks are well below the OECD average for the coal and natural gas, and its large volume of exports enhances the reliability and diversity of global supplies of these fuels. The country depends on oil imports for a large share of demand, however. Domestic oil production, most of which is offshore, peaked in 2000, and the amount of oil demand met by imports is expected to continue to grow.

In addition to its conventional oil and natural gas resources, Australia is home to potentially large unconventional resources. According to estimates developed by EIA, Australia could have as much as 17.5 billion barrels of crude oil (versus proved reserves of just 1.4 billion barrels) and 443 trillion cubic feet of natural gas (about 10 times its proved reserves).[5]

Australia's economy, however, is relatively energy intensive, with mining being a major contributor to the country's economy. Australia's energy intensity, a measure of the amount of energy it takes to produce a unit of GDP, and energy use per capita are higher than the OECD average, though they have showed some improvement in recent years. The country also is a relatively large emitter of carbon dioxide.

In the power sector, coal and natural gas are the main fuels, with renewables playing a very small role and nuclear power, which is prohibited, playing no role at all. This relative lack of diversity in the electric power sector is a negative factor vis-à-vis the OECD average. Nevertheless, because low-cost coal is the dominant fuel used in power production, Australia enjoys comparatively low electricity prices.

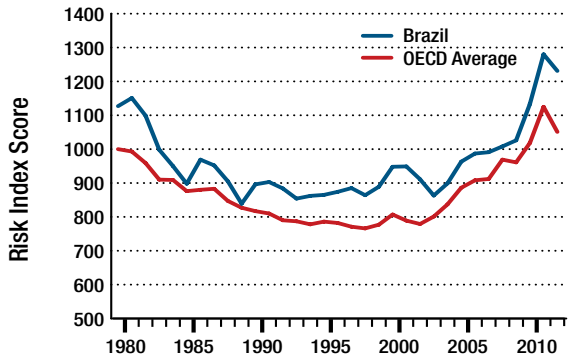
While Australia has outperformed most other countries in our group, many metrics are moving in the wrong direction. The gap between Australia and the OECD average for risks related to oil imports and energy prices and expenditures—once big advantages for Australia—have closed in recent years. Domestic oil production, most of which is offshore, peaked in 2000, and the share of oil demand met by imports is expected to continue growing. In addition, risk scores related to energy intensity, energy per capita, and carbon dioxide emissions continue to move higher relative to the OECD baseline.

BRAZIL

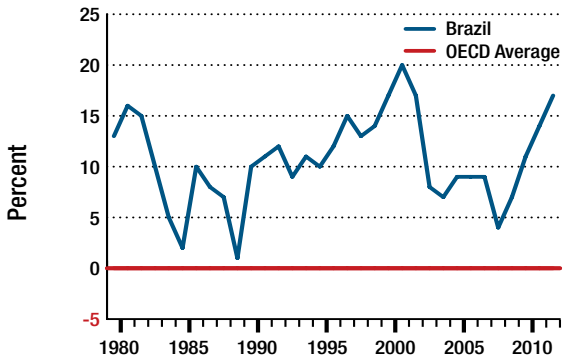
Energy Security Risk Summary: Brazil

Risk Scores:	
2012 Energy Security Risk Score	1,231
2012 Large Energy User Group Rank	20
Score in Previous Year	1,280
Rank in Previous Year	18
Score in 1980	1,127
Average Score: 1980-2012	965
Best Energy Security Risk Score	839 (1989)
Worst Energy Security Risk Score	1,280 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	11%
Best Relative Score	1% (1989)
Worst Relative Score	20% (2001)

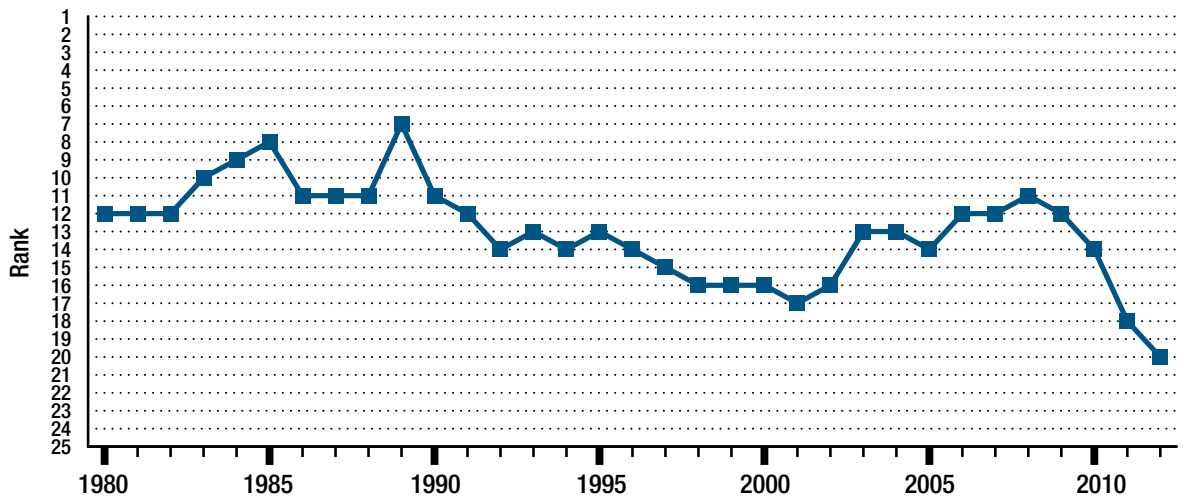
Brazil vs. OECD: Risk Index Scores



Brazil: Risk Variance from OECD



Brazil: Risk Ranking



Brazil's energy security risk scores consistently have been much higher than the OECD average. In 2012, Brazil's score of 1,231 was 20% higher than the OECD average. Since 2008, when it was ranked 11, the country has seen its energy security ranking drop nine places to 20. Its average rank over the 1980-2012 period is 13.0.

Brazil is poised to become a large producer and exporter of crude oil, and this should improve its energy security picture going forward. In 2009, Brazil became a net oil exporter. The country's large ethanol industry contributed to this by displacing some of the demand for petroleum-based liquid fuels. Brazil has been a net importer of natural gas since 1999, and its natural gas import risk remains above the OECD average. Coal presents a growing import risk, as domestic production has not kept pace with demand.

Recent "pre-salt" finds in deep water off Brazil's coast, which might contain as much as 50 billion barrels of oil equivalent, have the potential to increase domestic oil production significantly. Brazil recently awarded a consortium made up of state-owned Petroleo Brasileiro SA and firms from Europe and China rights to explore an offshore area called Libra. The government estimates the Libra field could hold as much as 12 billion barrels, which if accurate would make it one of the world's largest.

In addition, an examination of three shale formations by EIA estimates finds that technically recoverable resources of 5.4 billion barrels of oil and 245 trillion cubic feet of natural gas. If these assets (and potentially others) are tapped successfully, Brazil could see large reductions in risks related to oil imports and import expenditures. Estimates vary, but crude oil production in Brazil by 2020 could climb from a little over 2 million barrels per day today to a range of 3.5 to 4.2 million barrels per day.

Virtually all of Brazil's population now has access to at least some electricity. Those without power are mostly in the country's sparsely populated Amazon region. Brazil's electricity generating sector is dominated by hydropower, which accounts for about three-quarters of total capacity. This reliance on hydroelectric power means that Brazil's electric capacity diversity risks generally are worse than the OECD average, though new gas-fired and renewable capacity is being installed that will increase the diversity of its power generation sources.

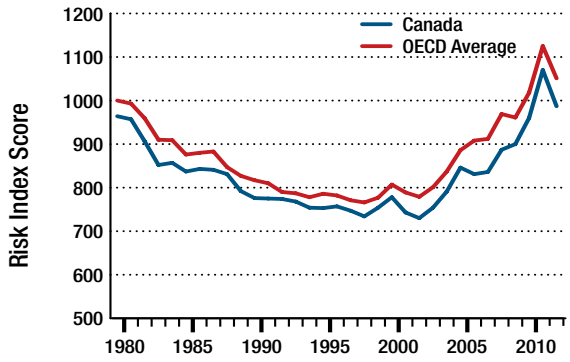
Brazil uses more energy and emits more carbon dioxide to produce a unit of GDP than the OECD average, not untypical of an emerging economy. Transportation sector risks also are increasing as a growing middle class purchases more automobiles. As the country develops further, risk metrics measuring energy use in the transport sector can be expected to move higher.

CANADA

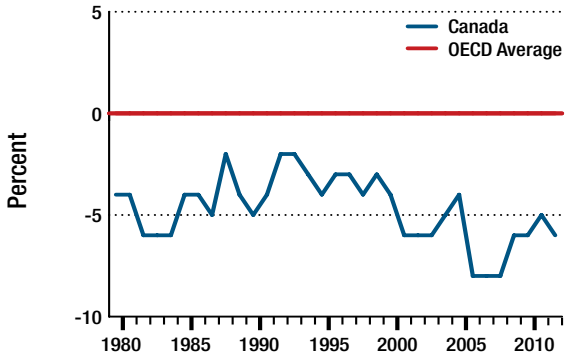
Energy Security Risk Summary: Canada

Risk Scores:	
2012 Energy Security Risk Score	987
2012 Large Energy User Group Rank	5
Score in Previous Year	1,070
Rank in Previous Year	6
Score in 1980	964
Average Score: 1980-2012	830
Best Energy Security Risk Score	730 (2002)
Worst Energy Security Risk Score	1,070 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	-5%
Best Relative Score	-8% (2006)
Worst Relative Score	-2% (1988)

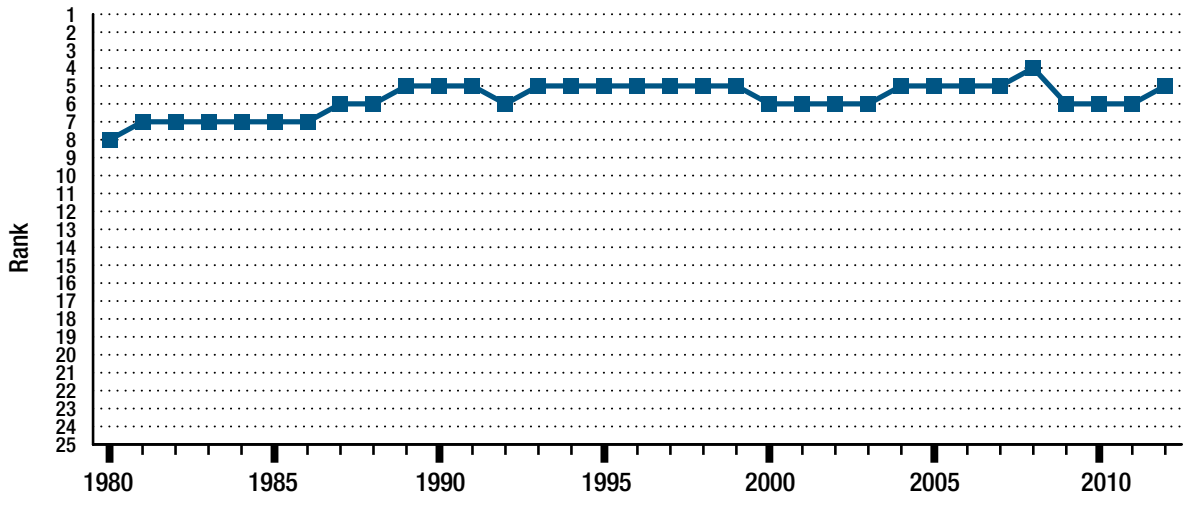
Canada vs. OECD: Risk Index Scores



Canada: Risk Variance from OECD



Canada: Risk Ranking



Canada's energy security risk scores have tracked closely, and always just below, the OECD average. Its overall risk score in 2012 of 987 was 6% lower than the OECD average. Since the early 1990s, Canada's risk scores relative to the OECD baseline have generally improved, though with a lot of variability. Over the entire 33-year period, Canada's overall ranking has steadily improved, from a 1980 ranking of eight to a 2012 ranking of five.

Canada has very large hydrocarbon and hydropower resources and is a large energy producer and exporter. It is the world's third largest producer of natural gas, sixth largest producer of crude oil, and fourth largest producer of coal. Canada is the single largest supplier of energy to the United States. Nearly all of it oil and natural gas exports are to the United States via pipeline. Only a small portion of its coal output is for domestic consumption, leaving plenty for export.

As a result, Canada scores very well in those metrics measuring oil, natural gas, and coal import exposure risks. Indeed, because Canada is politically stable, its production and export of these fuels enhances energy security globally by increasing the reliability and diversity of supplies.

The most significant development in Canada recently has been the addition of about 175 billion barrels of oil reserves from Alberta's oil sands, which marked a major improvement in the risk index for global crude oil reserves. As production from these reserves increases, the diversity and freedom (reliability) measures of world oil production should improve. Canada potentially also has very large reserves of shale gas. EIA estimates recoverable reserves of 573 trillion cubic feet, most of which is located in sedimentary basins in the western part of the country. Quebec, Nova Scotia, and New Brunswick may have shale plays, as well.

Production from Canada's Alberta oil sands could rise from the current 1.4 million barrels per day to more than 3.5 billion barrels per day by 2025, and some estimates are higher, still. To help move this output, TransCanada is proposing construction of the Keystone XL pipeline, a $7 billion pipeline expansion project. This project would increase the existing Keystone Pipeline system connecting Canada's oil sands resource to U.S. refining centers from a capacity of 591,000 barrels per day to more than 1.1 million barrels per day. (As of this writing, the president has failed to grant a needed construction permit for this pipeline.)

Whereas most countries view diversification of energy supplies as a strategic goal, Canada is in a position where the diversity of export outlets is becoming a bigger energy policy priority. To that end, two pipeline projects with a combined capacity of about 1.4 million barrels per day are under consideration that would carry Albertan oil to the Canada's West Coast, both of which could be commissioned sometime in 2017. In addition, an Energy East line could carry 1.1 million barrels per day of oil to refineries and ports on Canada's East Coast. Canada also has plans to export natural gas through LNG export terminals.[6]

Canada's power sector is diverse by OECD standards. It is among the world's largest producers of hydroelectric power, which accounts for about 60% of its electricity generation. Coal and nuclear account for 10% to 15% of output, respectively. Renewable sources also have grown in recent years and now generate about 5% of Canada's electricity. The country's electricity prices compare very favorably against the OECD average.

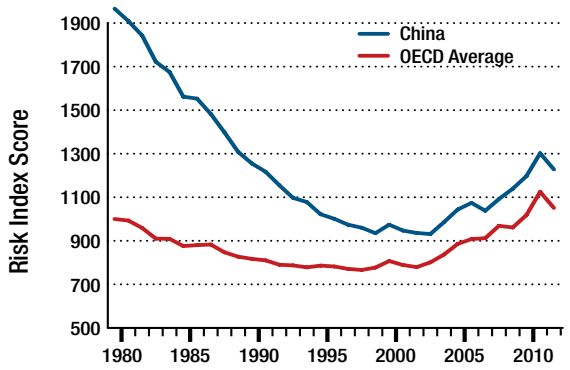
Canada's risk measures of energy intensity and energy use per capita, especially in the transportation sector, are above the OECD average. Canada is a large country with cold climate and a relatively low population density and a lot of mining and other energy intensive activity. It is not surprising, therefore, that its Canada's energy use per capita is very high and that its energy expenditures per capita are slipping against the OECD average. This is also reflected in Canada's relatively large carbon dioxide emissions per capita. While these metrics continue to perform worse than the OECD average, they nonetheless are improving at a faster rate than in the OECD as a whole.

CHINA

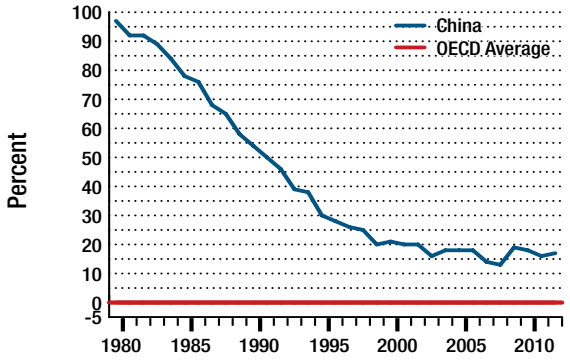
Energy Security Risk Summary: China

Risk Scores:	
2012 Energy Security Risk Score	1,228
2012 Large Energy User Group Rank	19
Score in Previous Year	1,302
Rank in Previous Year	20
Score in 1980	1,966
Average Score: 1980-2012	1,243
Best Energy Security Risk Score	931 (2003)
Worst Energy Security Risk Score	1,966 (1980)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	42%
Best Relative Score	13% (2008)
Worst Relative Score	97% (1980)

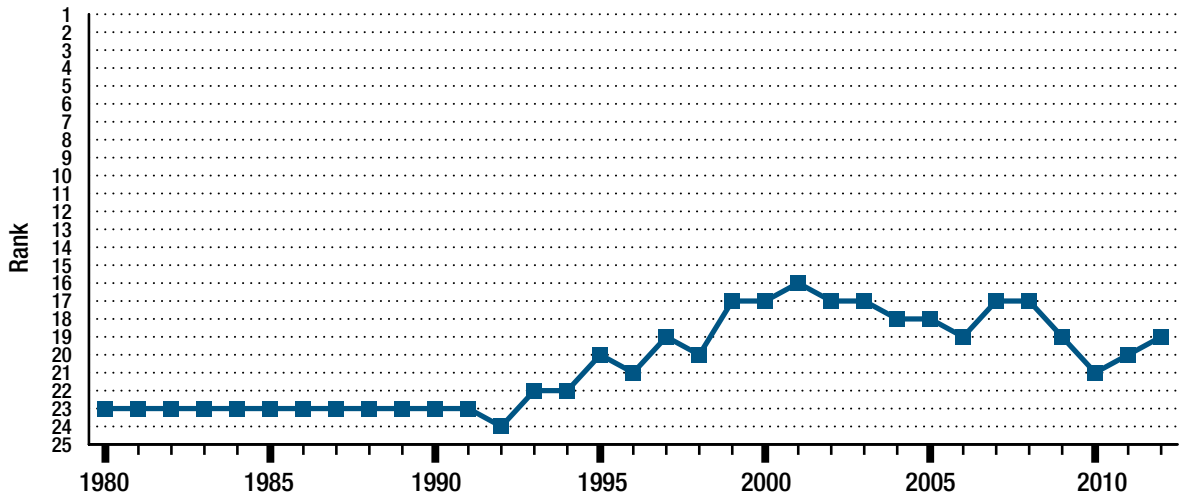
China vs. OECD: Risk Index Scores



China: Risk Variance from OECD



China: Risk Ranking



China has displayed a very wide range of risk scores over the years, with a high of 1,966 in 1980 to a low of 931 in 2003. From 1980 to 1991—a period that does not include data from Russia or the Ukraine—China was ranked last (23) even as its overall risks were declining. By the early 2000s, its risk score approached the OECD average, representing a tremendous improvement. Its best ranking of 16 was in 2001. However, over the last decade, a period of rapid economic growth, China's absolute risks have risen at about the same rate as for the OECD, and its relative risks have remained generally between 15% and 20% above the OECD average.

China's energy resources are among the largest in the world. The Congressional Research Service (CRS) estimates that China has the third highest fossil fuel reserves of any country in the world. Of its 475 billion barrels of oil equivalent oil, natural gas, and coal reserves, more than 90% are in coal.[7]

In 2010, China became the world's largest energy consumer. Increases in Chinese energy production have not been able to keep pace with demand, and it imports a growing portion of the fuels it uses. China became a net importer of oil in 1993 (it is now the world's largest net oil importer), natural gas in 2007, and coal in 2009. As a result, all of China's fuel import-related risk measures, show higher risks than in previous decades. So even while China's scores for these metrics remain better than the OECD average, they are moving in the wrong direction.

While China is the world's largest coal producer, it also is the world's largest coal consumer. Over 70% of China's energy is derived from coal. IEA forecasts that China's demand for coal will peak in 2020.[8]

Natural gas supplies only about 4% of China's energy demand, but its government would like to see this share increase and is moving to diversify foreign sources of supply and increase domestic production. China gets a large portion of its imported natural gas via pipeline from Central Asia. In September 2013, Russia's Gazprom and China's National Petroleum Corporation signed a framework for a long-term agreement under which Russia will supply at least 38 billion cubic meters of gas per year to China. The deal would require construction of a new Russian pipeline to China by 2018. In addition, about 15 LNG import terminals are in various staging of planning and construction.

EIA's recent shale gas study suggests that China has potentially huge resources of shale oil and gas[9] on the order of, respectively, 32 billion barrels and 1.1 quadrillion cubic feet. China is beginning to explore some of its shale formations in the hope of increasing domestic production.

Coal dominates China's power sector. Coal-fired plants account for more than 75% of total generation. Renewable hydropower is the second largest source of power generation in China with just under 20% of generation. At 18.3 gigawatts, its Three Gorges Dam hydroelectric facility along the Yangtze River is the world's largest, with its 32 generators capable of producing 22.7 gigawatts. Wind capacity has grown rapidly in recent years, but a shortage of transmission infrastructure means much of it is unconnected to the grid. Plans also call for more natural gas-fired and nuclear generating plants, which should improve the diversity of its electricity supply. China's government would like to increase its nuclear generating capacity. China now operates 17 nuclear reactors and has another 30 under construction. Rated at 33 gigawatts, the 30 plants being built represent about half of global nuclear capacity under construction.

As China has developed economically, its energy use risks, like in other emerging economies, have increased. China's energy intensity has improved steadily but still is well above the OECD average (third worst in the large energy user group behind only Russia and the Ukraine). Since 2000, as its middle class has grown and vehicle ownership has become more common, China's transportation energy intensity has gotten worse 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 a relatively riskier direction.

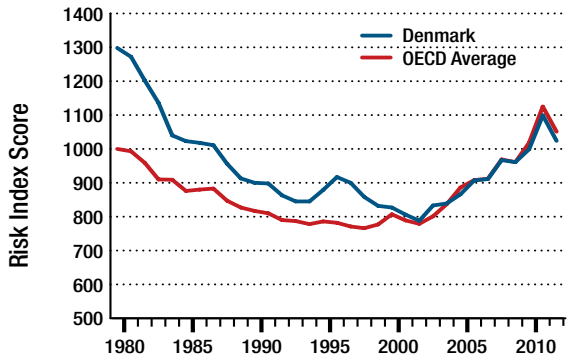
China's energy-related carbon dioxide emissions also are the highest in the world, and these, too, continue to grow rapidly. Since about 2000, China's economy generally has been carbonizing rather than decarbonizing, though the addition of some new hydro and nuclear capacity have lowered the carbon intensity of energy supplies in recent years.

DENMARK

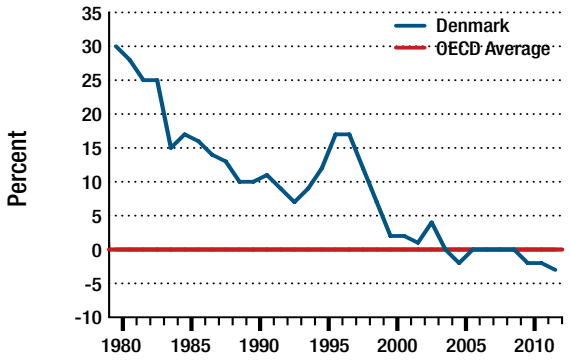
Energy Security Risk Summary: Denmark

Risk Scores:	
2012 Energy Security Risk Score	1,024
2012 Large Energy User Group Rank	8
Score in Previous Year	1,099
Rank in Previous Year	8
Score in 1980	1,298
Average Score: 1980-2012	953
Best Energy Security Risk Score	788 (2002)
Worst Energy Security Risk Score	1,298 (1980)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	9%
Best Relative Score	-3% (2012)
Worst Relative Score	30% (1980)

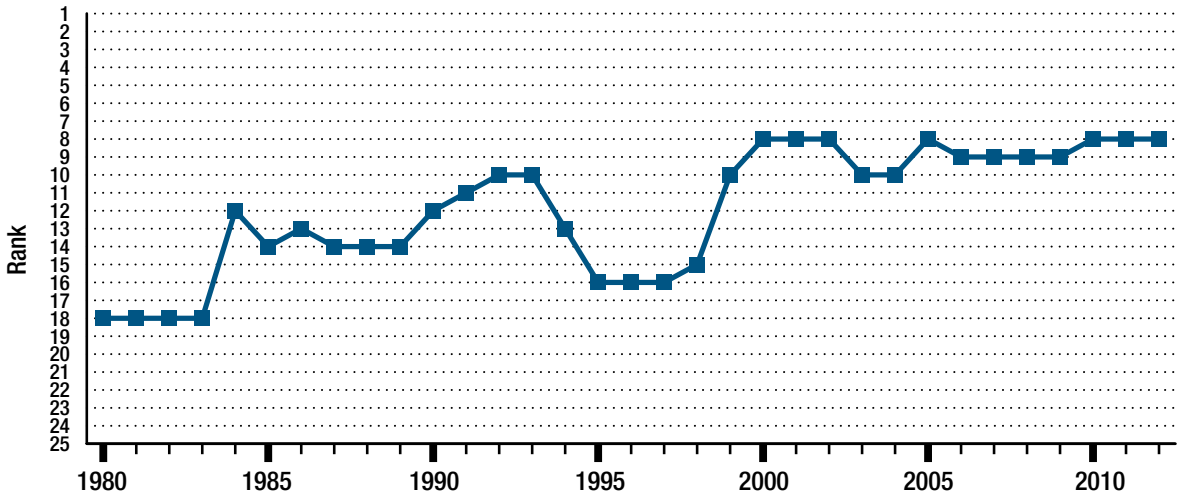
Denmark vs. OECD: Risk Index Scores



Denmark: Risk Variance from OECD



Denmark: Risk Ranking



Denmark's 2012 risk score of 1,024 earned it the number eight spot in the large energy user group ranking. Except for a period in the mid 1990s when energy expenditures and volatility risks were quite high, Denmark's rankings have improved gradually since 1980, when it was ranked 19. Since 2004, its risks scores have been at or below the OECD average.

Denmark produces small amounts of oil and natural gas almost entirely from fields located in the North Sea. Production of these fuels is enough, however, to make the country a net exporter of both, beginning in 1996 for oil and 1984 for natural gas. The country produces no coal and must import what it uses. When all of these fuels are taken into account, Denmark's import expenditure risks are much lower than the OECD average.

Denmark has a fairly high level of diversity in the power sector, with generation being about evenly divided between coal and renewables, and a significant and growing amount of natural gas. Since about 1997, Denmark has installed a relatively large amount of renewable capacity, mostly wind and biomass/waste. More natural gas also is being used. Each of these factors has helped reduce the need for coal imports, which has lowered the country's coal-related import risks (though this risk remains higher than the OECD average). The shift towards more expensive sources of energy, however, is seen in Denmark's electricity prices, which are much higher than the OECD average.

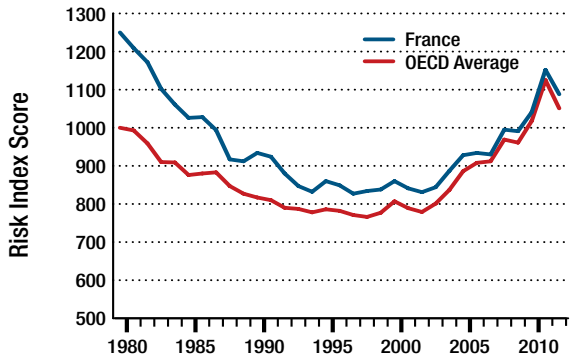
Moderating the risks from increasing energy prices is efficiency in use of energy. The country is one of the most energy efficient in the world, and its energy intensity in 2012 was the best among the large energy user group. Generally, the amount of energy, oil, or transportation fuel relative to a unit of GDP in Denmark is lower than the OECD average, and the average amount used by each person also is lower. Denmark's carbon dioxide emission trends generally are in line with the OECD average.

FRANCE

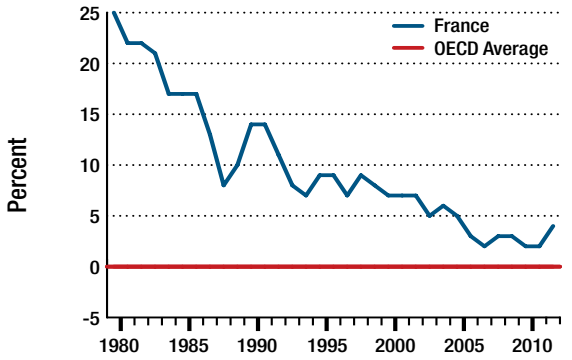
Energy Security Risk Summary: France

Risk Scores:	
2012 Energy Security Risk Score	1,088
2012 Large Energy User Group Rank	10
Score in Previous Year	1,152
Rank in Previous Year	10
Score in 1980	1,250
Average Score: 1980-2012	958
Best Energy Security Risk Score	827 (1997)
Worst Energy Security Risk Score	1,250 (1980)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	10%
Best Relative Score	2% (2007)
Worst Relative Score	25% (1980)

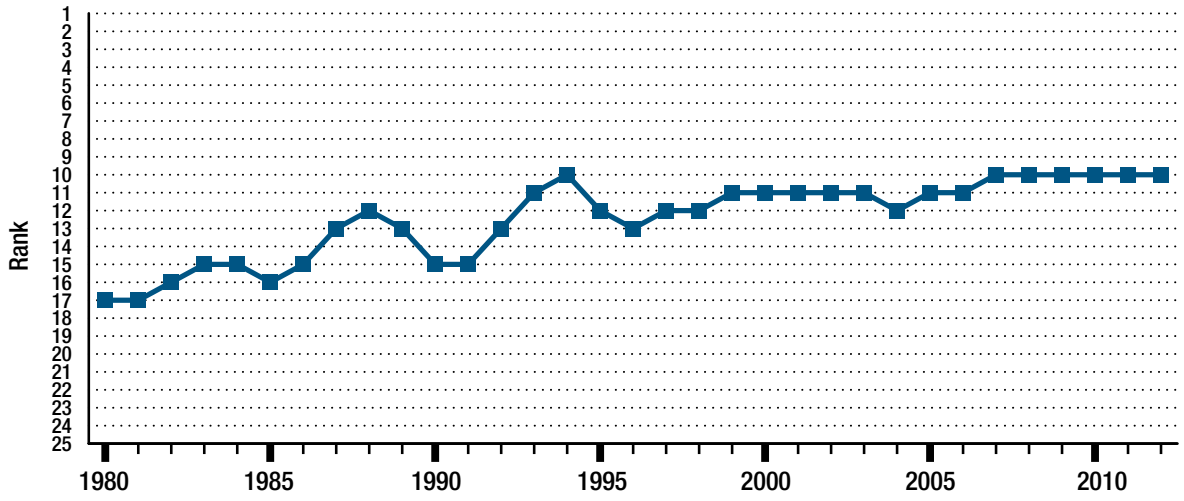
France vs. OECD: Risk Index Scores



France: Risk Variance from OECD



France: Risk Ranking



With a rank of 10, France's energy security score of 1,088 for 2012 was 4% higher than the OECD average. While in absolute terms, France's overall energy security risk score for 2012 is not all that much below its 1980 score, the country has improved its energy security posture greatly relative to its peers. Since 1980, France risk scores have moved progressively closer to the OCED average, and its ranking has improved by seven places. France displays a relatively high degree of energy efficiency that helps moderate a variety of risks, and its strategic decision to make nuclear power a substantial part of its energy mix has helped France lower it fossil fuel imports.

France has very little in the way of oil, natural gas, and coal resources, so it must rely on imports for much of its energy supply. Energy import risks are therefore a big factor pushing France's energy security risk index higher in recent years, though at a slower rate than the ODEC average. France has two fairly large shale basins, but they are currently off limits to exploration and production.

The country made a strategic decision to make nuclear power a substantial part of its energy mix. From 1980 to 1990, France added about 40 gigawatts of nuclear capacity, and nuclear power now accounts for about half of total installed capacity and nearly 80% of generation. The decision to pursue nuclear power has kept France from importing even more oil, natural gas, or coal for electricity generation and has increased the amount of non-emitting generating capacity. Thus, nuclear power has been a decidedly positive factor in France's energy security.

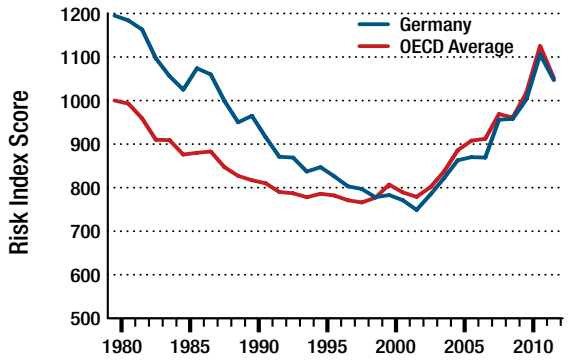
France also displays a relatively high degree of energy efficiency, overall and in the transport sector, that helps moderate a variety of risks, and its three carbon dioxide emission metrics are slightly better than their comparable OECD averages.

GERMANY

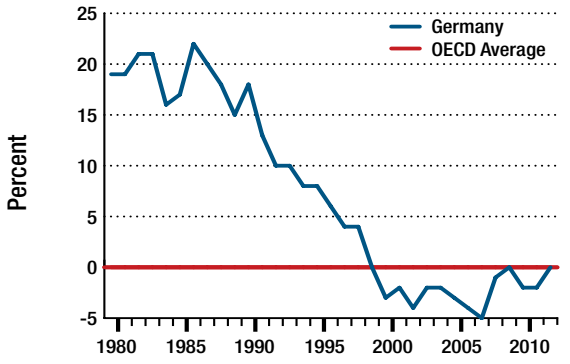
Energy Security Risk Summary: Germany

Risk Scores:	
2012 Energy Security Risk Score	1,047
2012 Large Energy User Group Rank	9
Score in Previous Year	1,106
Rank in Previous Year	9
Score in 1980	1,195
Average Score: 1980-2012	936
Best Energy Security Risk Score	749 (2002)
Worst Energy Security Risk Score	1,195 (1980)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	7%
Best Relative Score	-5% (2007)
Worst Relative Score	22% (1986)

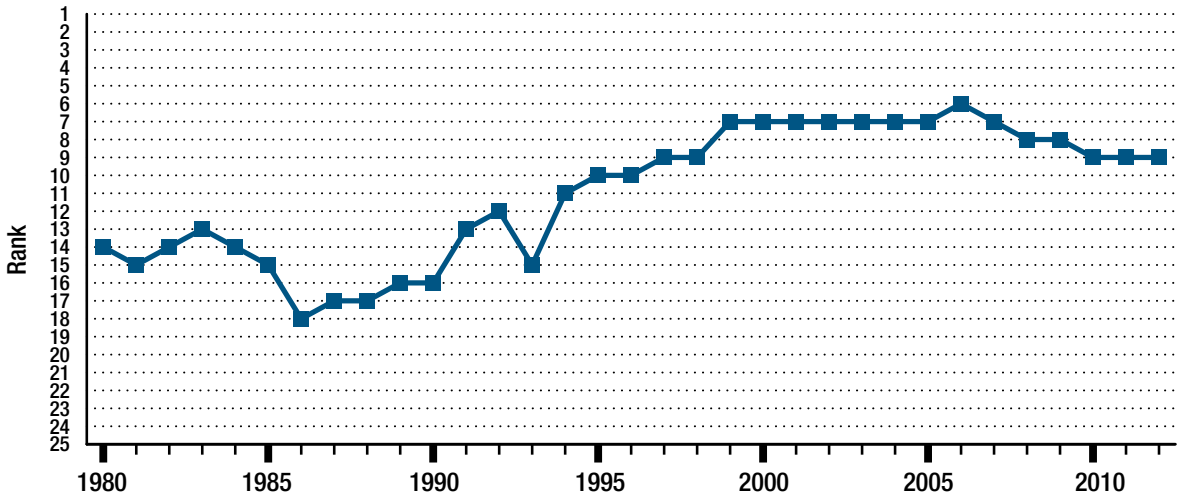
Germany vs. OECD: Risk Index Scores



Germany: Risk Variance from OECD



Germany: Risk Ranking



Note: 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.

Germany's energy security risk score of 1,047 for 2012 was essentially the same as the OCED average. Its energy security is ranked nine in the large energy user group. From 1980 to 2000, Germany's energy security risks declined steadily, both in absolute terms and relative to the OECD baseline, and its rank improved from 14 to seven. Since 2000, however, the country's scores have tended to track fairly closely with the OECD as a whole, and it has slipped two places in the ranking.

Germany is Europe's top energy user. The country relies on imports to meet a large share of its need for oil, natural gas, and coal. As a result, its import risks for oil, natural gas, and total energy are higher than the OECD average, as are its energy import expenditures as a share of GDP. While conventional production of natural gas is expected to continue to decline, Germany has a large shale resource that could hold 17 trillion cubic feet of recoverable natural gas. Draft legislation has been proposed that would allow hydraulic fracturing outside water protection areas.

Coal remains the lowest-cost generating option in Germany, and presently coal plants account for about 40% of power generation. Indeed, Germany is the largest coal user in the European Union. Although hard coal production is being phased out, lignite production is expected to increase. The EIA projects that Germany will add 8 gigawatts of new coal-fired generating capacity that would be fueled by imported hard coal and 3 gigawatts fueled by domestic lignite, which would be in addition to the 2 gigawatts of lignite-fueled capacity that came on line in 2012.

The diversity within Germany's power sector is quite good compared to other countries. Coal-fired plants are the largest generating source, with nuclear, natural gas, and renewables each contributing 10% to 20% of electricity output. In response to the Fukushima Daiichi nuclear accident, however, the German government made the decision to close its nine nuclear reactors by 2022. Moreover, the extremely high price of natural gas in Germany is making it increasingly difficult to operate natural gas plants profitably. Indeed, the combination of the nuclear shutdown, the very high cost of natural gas, and the low costs of a carbon credit in the European Union's Emissions Trading System has led to greater coal use in the power sector, and some of that increased demand is being met with U.S. coal. Under the country's "Energiewende" policy, ambitious renewable targets also have been set, including an offshore capacity target of 6.5 gigawatts of offshore wind by 2020 rising to 15 gigawatts by 2030.[10]

German electricity rates are very high, and since 2000 have grown at a much faster rate than the OECD average. Energy-intensive industries purchase electricity on the wholesale market, which helps shield them from these high prices.

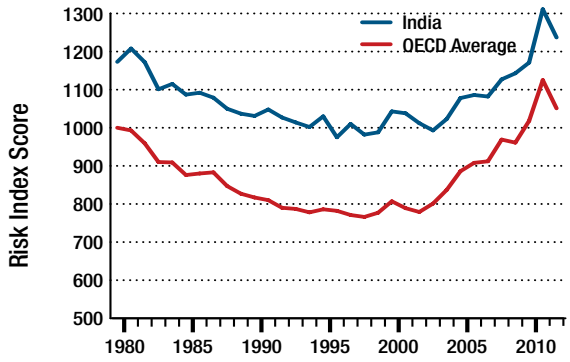
Germany is among the most efficient in the large energy user group. It uses less energy per person and dollar of GDP than the OECD average, both overall and in the transportation sector, and its carbon dioxide emissions also are modestly lower. Improvement in all of these metrics is roughly at the same pace as the OECD average.

INDIA

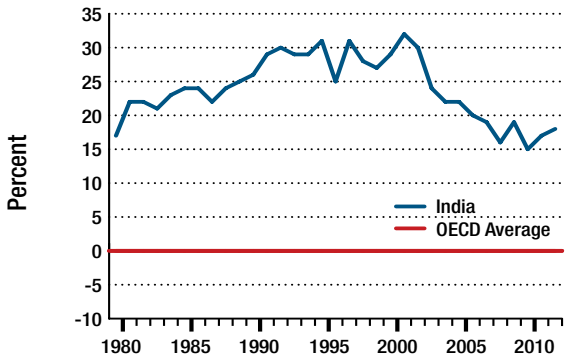
Energy Security Risk Summary: India

Risk Scores:	
2012 Energy Security Risk Score	1,237
2012 Large Energy User Group Rank	21
Score in Previous Year	1,311
Rank in Previous Year	21
Score in 1980	1,173
Average Score: 1980-2012	1,078
Best Energy Security Risk Score	975 (1996)
Worst Energy Security Risk Score	1,311 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	24%
Best Relative Score	15% (2010)
Worst Relative Score	32% (2001)

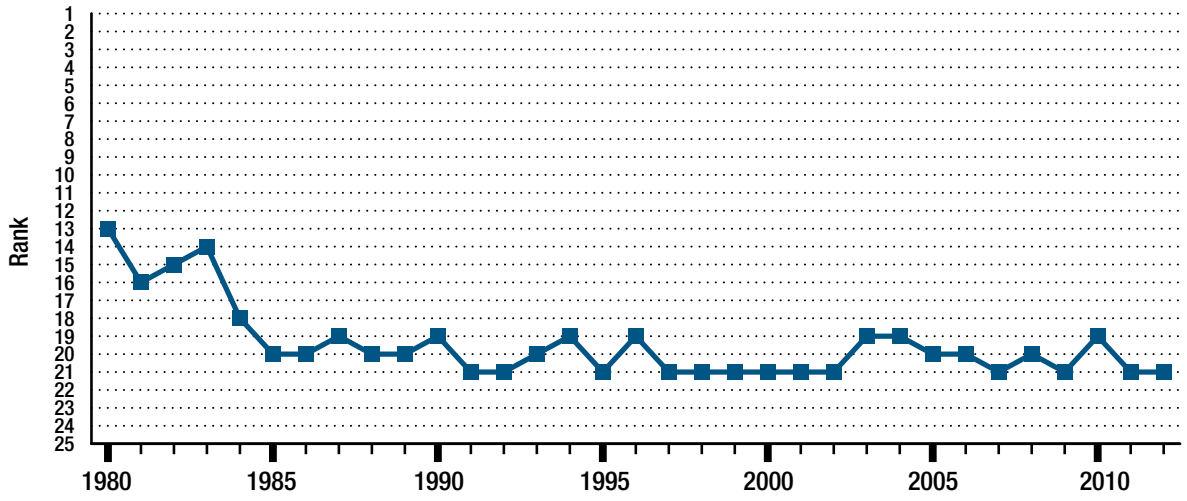
India vs. OECD: Risk Index Scores



India: Risk Variance from OECD



India: Risk Ranking



India total energy security risk for 2012 ranks in the bottom five of the large energy user group. India's 2012 energy security risk index score of 1,237 placed it in 21st position. From 1980, when it was ranked 13, to 2000, India's energy security risks generally improved in absolute terms but deteriorated when compared to the OECD baseline over the same period. Since 2000, while its absolute energy security risks grew—a trend evident in many other countries in the large energy user group—they did so a slower rate than for the OECD as a whole. On average, since 1980 India has been ranked 19.5.

Increasing the availability of energy to its people is a priority for India. While it is the world's fourth largest energy consumer, that is primarily due to its a population in excess of 1 billion people. India's GDP per capita is the lowest in the large energy user group, and with hundreds of millions of people lacking access to electricity, its energy consumption per capita also very low.

Imports are needed to meet all of India's large and growing domestic energy requirements. Since 1980, India has been a net import of oil and natural gas (though it is a net exporter of refined products from seven refineries). Though it is among the largest coal producers in the world, the country has been a net coal importer since 2004. Despite these trends, its import posture is about as good, if not a little better than, the OECD average.

Coal is the dominate fuel in India's economy, supplying more than 40% of primary energy demand, and it is expected to remain India's primary fuel well into the future. IEA forecasts coal use in India will continue to rise, and in 2025, India will overtake the United States as the world's second-largest coal user, behind only China. (The IEA notes that China and India combined will account for three quarters of the growth in non-OECD coal use to 2035.) To feed this demand, IEA expects coal imports to grow, and by 2020, India will become the world's largest coal importer.

Natural gas is a relatively small player in India's energy economy, accounting for less than 10% of demand, and most of it is imported. EIA suggests that, at 96 trillion cubic feet, potential shale gas resources are more than double India's current reserve estimate.

India's retail electricity rates are very low compared to the OECD average, which reflects a number of factors, including government policy. India's power sector, however, is not very diverse. Coal is the dominant fuel in the electricity sector. Since 1980, India has added about 90 gigawatts of thermal generating capacity, most of which was coal-fired. Hydroelectric power has also been a large supplier of power. In 1980, it was about one-third of installed capacity, but that share has fallen to about one-fifth today. Still, India has the sixth largest hydroelectric capacity in the world. India also has added about 4 gigawatts of nuclear power since 1980, and additional nuclear facilities are being planned. A 4 gigawatt solar facility also is in the works.

Inadequate fuel supplies means the country's electricity generation often is insufficient to meet demand. Grid expansion also has not kept pace with demand, causing some industrial customers to rely on off grid sources of power. In 2012, India's Central Electricity Authority reported power deficits of up to 8% during some months, and two massive blackouts affected large sections of the country. As India develops further, investment in modern energy infrastructure will be needed to avoid power interruptions and to increase energy access.

Like many emerging economies, India's economy is relatively inefficient in its energy use. Its energy intensity across the economy and in the transport sector compare unfavorably with the OECD average. These measures, however, have been showing improvement, as GDP grows faster than energy use.

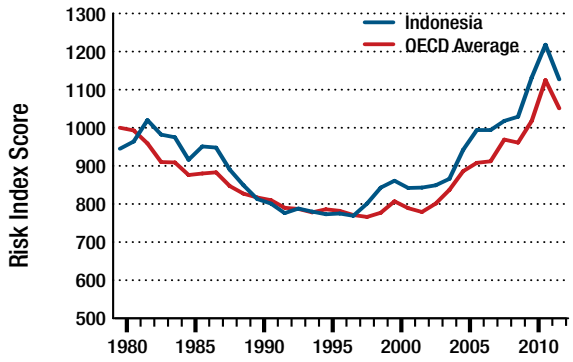
India also is a major emitter of carbon dioxide, but again more to its large population rather than its per capita emissions, which are quite small (but growing). India's economy over the entire period since 1980 has been carbonizing consistently rather than decarbonizing, a not uncommon situation for an emerging economy to find itself in.

INDONESIA

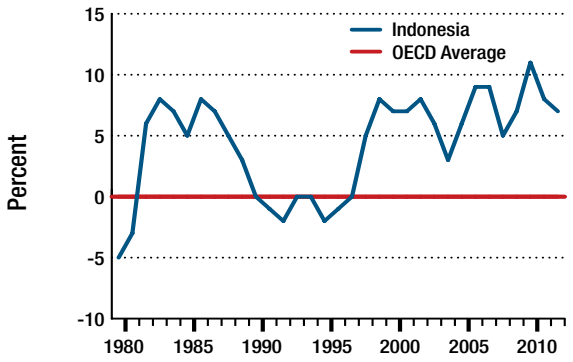
Energy Security Risk Summary: Indonesia

Risk Scores:	
2012 Energy Security Risk Score	1,127
2012 Large Energy User Group Rank	12
Score in Previous Year	1,218
Rank in Previous Year	12
Score in 1980	945
Average Score: 1980-2012	911
Best Energy Security Risk Score	769 (1997)
Worst Energy Security Risk Score	1,218 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	4%
Best Relative Score	-5% (1980)
Worst Relative Score	11% (2010)

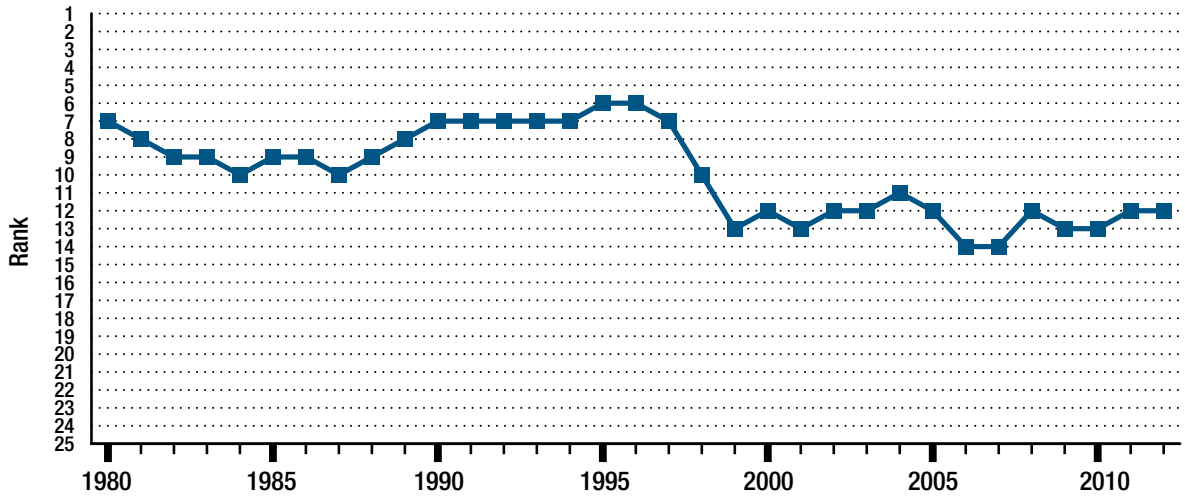
Indonesia vs. OECD: Risk Index Scores



Indonesia: Risk Variance from OECD



Indonesia: Risk Ranking



From 1980 to the mid 1990s, Indonesia's energy security was consistently ranked in the top 10 of the large energy use group, reaching as high as number six. Since the mid 1990s, however, its scores have trended higher relative to the OECD average. Worsening energy use and energy expenditure metrics were largely responsible for the step-wise drop in ranking the occurred in the late 1990s. Its 2012 score of 1,127 is 7% higher than the OECD average, good enough for a ranking of 12.

Since 1980, Indonesia's primary energy demand has increased more than 400%. Indonesia is rich in energy resources, producing large amounts of oil, natural gas, and, especially, coal. It is a large exporter of natural gas and coal.

Indonesia has had difficulty attracting private investment, which has affected its ability to replenish domestic supplies to meet rapidly growing demand. The country was for many years a large exporter of oil, but because of a combination of increasing demand and declining production, in 2004 it became a net importer of oil, and in January 2009 it suspended its membership in OPEC. As a result, Indonesia's oil and natural gas import risks, while still favorable compared to the OECD average, are moving higher and are largely responsible for the Indonesia's worsening energy security posture relative to OECD baseline. EIA's *Technically Recoverable Shale Oil and Shale Gas Resources* report, however, suggests Indonesia could have large quantities of shale oil and natural gas, which if tapped would contribute to lower risks.

The diversity of Indonesia's power sector has improved greatly since, 1980, when more than 80% of its power production came from oil-fired power plants and none from coal- or natural gas-fired plants. Today, oil is used to generate only about 20% of the country's electricity while coal generates about 40% and natural gas 25%. The use of coal in power generation is encouraged because of its abundant supply and low cost, especially compared to fuel oil. IEA expects that by 2035, coal plants will provide 66% of Indonesia's electricity generation.[11] Indonesia also is the world's third largest producer of electricity from geothermal sources, and a new 330 megawatt geothermal power plant will come online no later than 2018. Feed-in tariffs support geothermal and other renewable electricity production.

Indonesia's energy use per capita measures are much lower than the OECD average. One reason for this is that, according to an IEA estimate, 27% of the population lacks access to electricity. Energy is a key factor in economic growth, so this lack of energy access is reflected in Indonesia's GDP per capita metric, which is the second worst in the large energy user group, behind only India's.

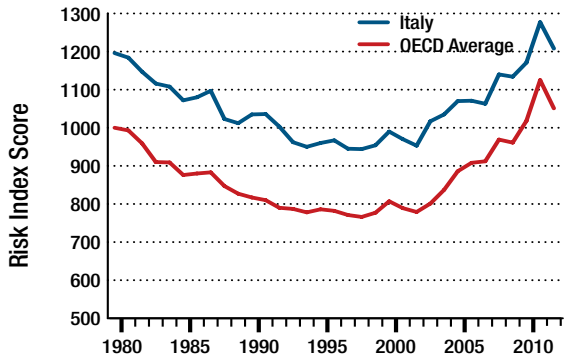
Like most other large emerging economies, emissions of carbon dioxide from energy pose an increasing risk relative to the OECD baseline.[12] Perhaps the largest risks are those connected to energy use overall and in the transportation sector. The amount of energy used to produce a unit of GDP in Indonesia is about the same as it was in 1980, but IEA expects this will improve y 2.3% per year out to 2035, the fastest pace of any country in Southeast Asia.

ITALY

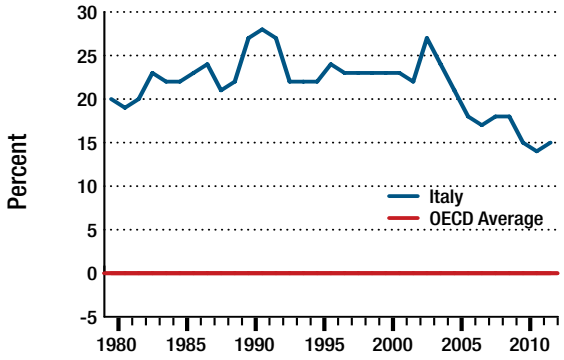
Energy Security Risk Summary: Italy

Risk Scores:	
2012 Energy Security Risk Score	1,208
2012 Large Energy User Group Rank	17
Score in Previous Year	1,277
Rank in Previous Year	17
Score in 1980	1,196
Average Score: 1980-2012	1,057
Best Energy Security Risk Score	944 (1998)
Worst Energy Security Risk Score	1,277 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	21%
Best Relative Score	14% (2011)
Worst Relative Score	28% (1991)

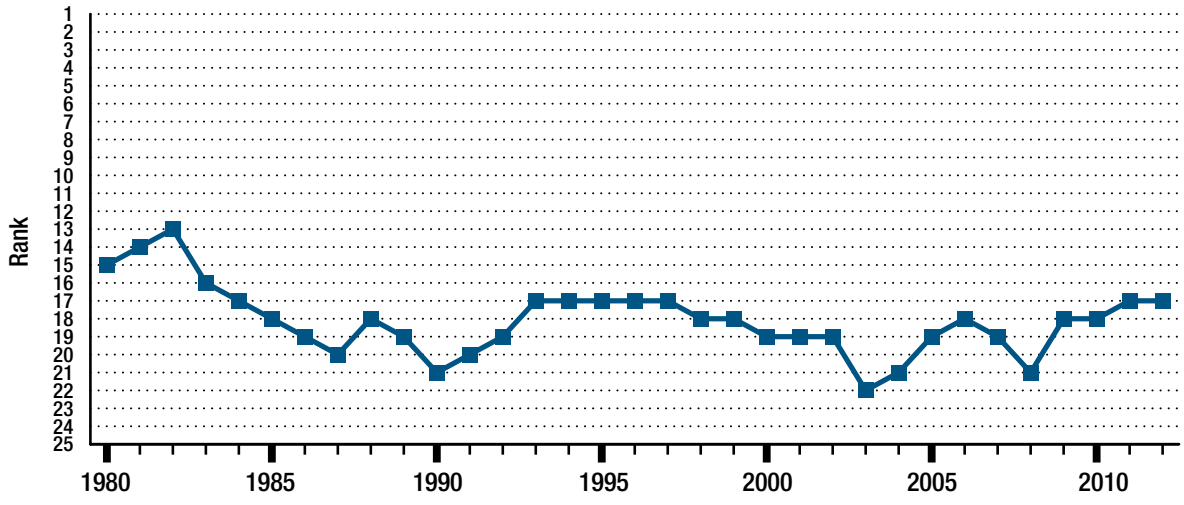
Italy vs. OECD: Risk Index Scores



Italy: Risk Variance from OECD



Italy: Risk Ranking



Italy's overall energy security risk has consistently been quite a bit higher—14% to 28%—than the OECD average, and at 1,057, its average risk score is one of the highest among developed countries. Its 2012 score was 1,208, which put it in 17th place.

Italy produces very little of its own energy, and like many Western European countries, it relies largely on imports to fuel its economy. As a consequence, its import supply and expenditure risks, especially those related to coal, are greater than the OECD average. Moreover, 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, and towards natural gas, which is now the most widely used fuel for producing electricity. Coal use also has been growing. Non-emitting capacity is about evenly split between hydroelectric and other renewables. Italy's small nuclear capacity did not produce any power after passage of an anti-nuclear power referendum in 1987 following the Chernobyl nuclear accident in 1986.

Because of its reliance on expensive natural gas and its increase use of renewables for electricity generation, Italy's electricity prices are among the highest in the large energy user group. Indeed, according to IEA, its rates for industrial users are by far the highest in the OECD.

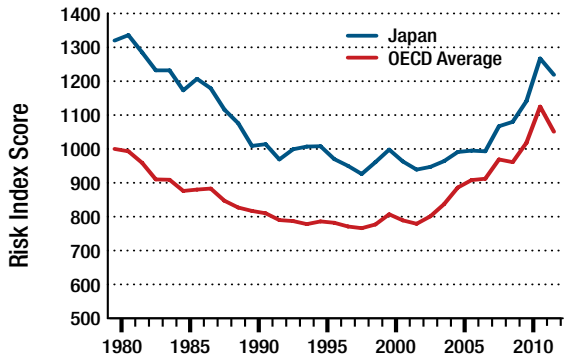
Italy's energy use metrics, especially its energy use per capita metrics, are better than the norm for the OECD countries. Its carbon dioxide emission also trend somewhat better than the OECD as a whole.

JAPAN

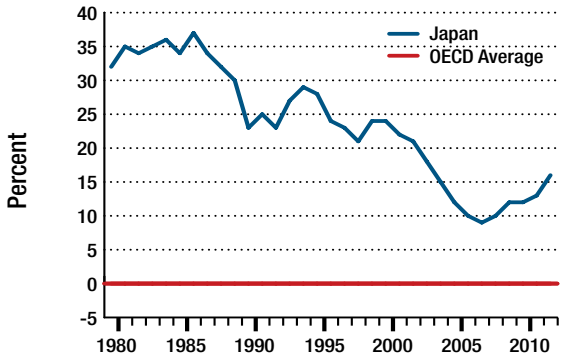
Energy Security Risk Summary: Japan

Risk Scores:	
2012 Energy Security Risk Score	1,219
2012 Large Energy User Group Rank	18
Score in Previous Year	1,267
Rank in Previous Year	14
Score in 1980	1,320
Average Score: 1980-2012	1,077
Best Energy Security Risk Score	926 (1998)
Worst Energy Security Risk Score	1,336 (1981)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	24%
Best Relative Score	9% (2007)
Worst Relative Score	37% (1986)

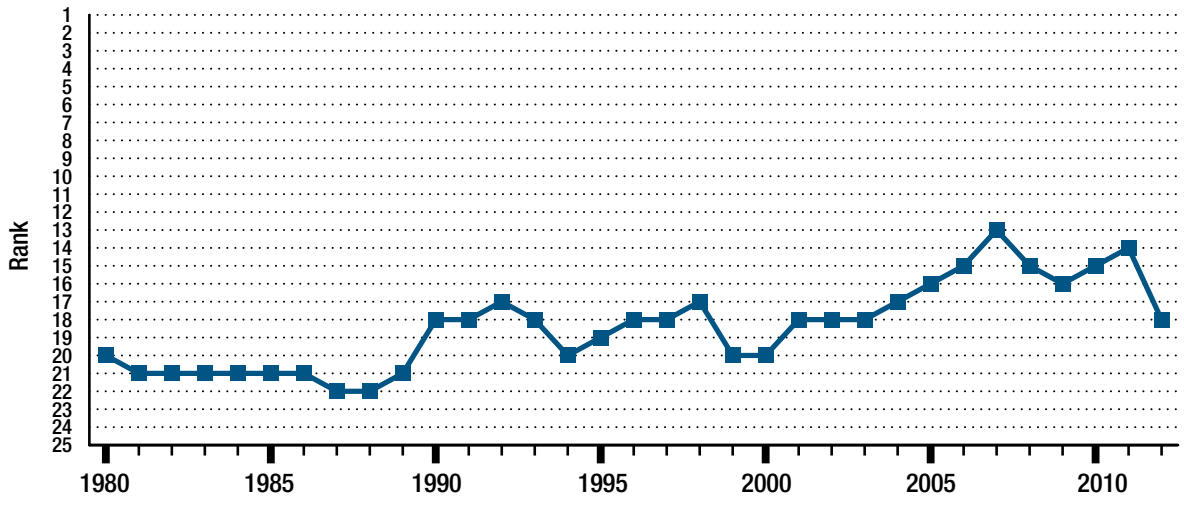
Japan vs. OECD: Risk Index Scores



Japan: Risk Variance from OECD



Japan: Risk Ranking



With few domestic energy resources, Japan faces many energy security challenges, and it has one of the highest energy security risk scores of any of the developed countries in the large energy users group. Its average energy security rank is 18. Nevertheless, since the mid-1980s Japan has improved it energy security posture vis-à-vis its large energy user peers and closed the gap with the OECD average. From more than 35% above the OECD in 1980s, Japan's score was just 13% above in 2011, good enough for a ranking of 14 among the large energy user group. However, in 2012 Japan's score jumped to 16% above the OECD average, and its ranking slipped from to 18. The shutting down of much of Japan's nuclear capacity was responsible for much of the change in 2012.

Japan produces very small quantities of crude oil and natural gas, and it 2001, it stopped producing coal altogether. As a consequence, Japan is among the world's largest importers of oil, LNG, 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.

Shale does not appear to be an alternative for Japan, but it does has a large methane hydrate resource. In March 2013, a Japanese energy exploration company successfully extracted natural gas from methane hydrate deposits of the coast of Japan. Estimates suggest a 100 supply of natural gas off Japan's coast, and if techniques can be developed to produce economically methane gas from hydrates in commercial quantities, it would be a tremendous step forward in Japan's energy security.

The diversity of generating capacity and the share of non-carbon emitting generation in Japan's power sector compare favorably to the OECD. The Fukushima Daiichi nuclear incident in March 2011 could change that, however. Japan invested heavily in nuclear power as a bulwark against unreliable supplies of imported fossil fuels. From 1980 to 2010, Japan added nearly 30 gigawatts of nuclear capacity (to 45 gigawatts total), and in 2012, its 54 reactors accounted for roughly 17% of installed capacity and 25% of generated electricity. These plants also are Japan's only significant source of emissions-free power.

By March 2012, however, all but two of the country's 54 nuclear reactors had been shut down, and under public pressure they remained closed for the remainder of the year. To fill the gap, Japan has had to import greater amounts of LNG, coal, and oil to fuel existing plants, including plants brought out of retirement. These actions have lead to greater fuel import insecurity, even higher electricity costs and energy expenditures, greater carbon dioxide emissions, and a loss of generating capacity diversity, offsetting many of the gains Japan made relative to its peers in the large energy user group. There are some recent indications, however, that Japan may restart a significant amount of its nuclear capacity.

A great advantage Japan has is its high level of energy efficiency, which acts to moderate and offset some of the unavoidable risks of importing so much energy. For example, Japan's import expenditures as a share of GDP and per person would be much higher if its economy were not as efficient as it is, and the country's energy use measures compare quite favorably with the OECD average.

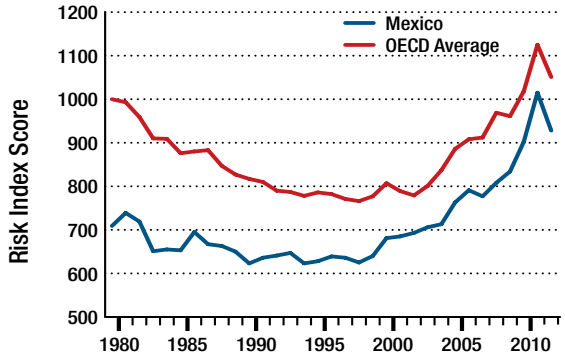
Japan also has a very efficient transportation sector. Its energy use and per capita energy use in this sector are two other measures that are clearly better than their corresponding OECD averages.

MEXICO

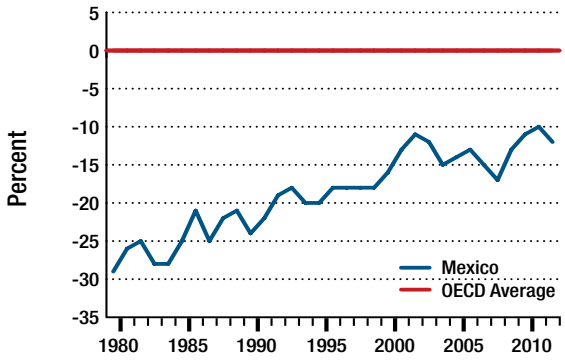
Energy Security Risk Summary: Mexico

Risk Scores:	
2012 Energy Security Risk Score	928
2012 Large Energy User Group Rank	2
Score in Previous Year	1,015
Rank in Previous Year	2
Score in 1980	709
Average Score: 1980-2012	710
Best Energy Security Risk Score	623 (1994)
Worst Energy Security Risk Score	1,015 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	-19%
Best Relative Score	-29% (1980)
Worst Relative Score	-10% (2011)

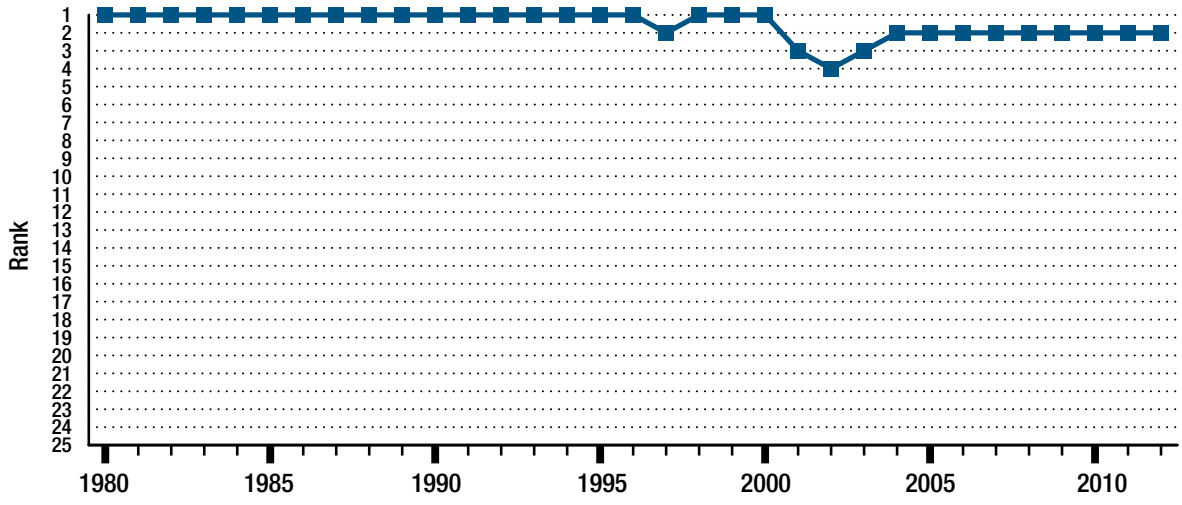
Mexico vs. OECD: Risk Index Scores



Mexico: Risk Variance from OECD



Mexico: Risk Ranking



Except for a few years in the early 2000s, Mexico's energy security since 1980 ranked first or second in the large energy user group, and with a score of 928 was number two in 2012. Mexico's 2012 energy security risk score, however, is much higher (219 points) than its 1980 score, and it risks are increasing at a faster rate than for the OECD as a whole. As a result, Mexico's relatively strong position is shrinking: From a 1980 score 29% better than the OECD average, its score in 2012 was just 12% better.

Mexico scores well primarily because of its comparatively good fossil fuel import, energy expenditure, and per capita energy use scores. Mexico has a large domestic energy sector, focused primarily on oil. Oil production levels are declining, however. Output from Cantarell, Mexico's largest oil field located off Mexico's southeastern coast, has fallen sharply in recent years, and increases from other fields have not been enough to offset this decline, resulting in a 25% reduction in oil output over the past decade.

The State-owned oil company Petroleos Mexicanos (Pemex), nationalized in 1938, is one of the world's largest, and under the Mexican constitution, it is granted what amounts to a monopoly on the exploration, processing, and sale of petroleum. Not wanting to be left behind the boom in oil production occurring in the United States and Canada, the Mexican government recently moved to modernize its oil sector by amending its constitution to give private energy companies a share in oil production and licenses. The move is designed to attract investment in shale deposits and ultra-deep water oil, in particular, and could potentially open up vast untapped oil and natural gas reserves and reverse the slide in Mexican output.

Mexico has very large reserves of natural gas, and it is a fairly large producer of natural gas, but many reserves remain untapped. Since 1989, natural gas imports have had to supplement domestic supplies and meet demand. Mexican imports of U.S. natural gas have nearly doubled since 2008 and could conceivably take 10% of U.S. production. Mexico is reportedly planning about 5,450 miles of new gas pipelines across the country, most of which will be focused on accessing U.S. shale gas. Moreover, with LNG terminals on both the Gulf and Pacific coasts, Mexico now imports LNG from as far afield as Indonesia, Nigeria, Peru, Yemen, and elsewhere. Mexico also produces modest amounts of coal but has been a net importer of this fuel over the entire 31-period.

Mexico has potentially large shale oil and natural gas resources. EIA estimates Mexico's shale gas resource at 545 trillion cubic feet, comparable to EIA's U.S. estimate, and its shale oil resource at 13.1 billion barrels of crude oil, an amount about 30% higher than its proved reserves. Moves to loosen restrictions on foreign investment were triggered in part by a desire to bring into the country the expertise to tap these resources.

Mexico's power sector has become increasingly diverse. Thermal power plants dominate, in particular natural gas plants. Over the past decade or so, Mexico has been backing out oil-fired generators and replacing them mainly with natural gas. The country also employs coal, hydroelectric power, and one nuclear reactor.

Mexico enjoys a clear comparative advantage in those metrics measuring the costs of energy. The amount it spends on fuel imports per dollar of GDP generated is well below the OECD average. Moreover, its energy expenditures per dollar of GDP and per capita are lower, as are its costs for electricity.

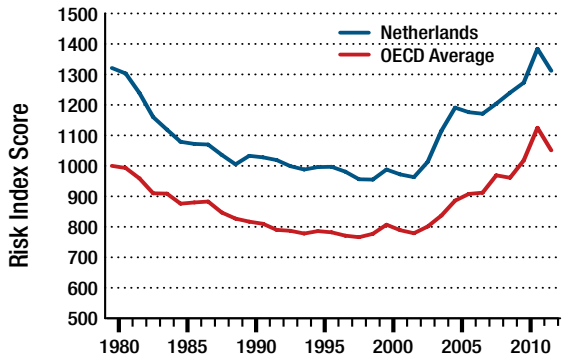
The amount of energy each person uses, both overall and in the transport sector, and the amount of carbon dioxide each person emits also is less than the OECD average. The spread between the Mexican and OECD per capita consumption, however, has been narrowing over the last decade or so. As Mexico continues to grow and develop and its middle class expands, this difference should narrow even further. Mexico also scores comparatively worse in those aspects related to energy intensity and emissions intensity. One exception to this may be petroleum intensity. With oil being removed from the power sector, this metric is expected to continue to improve at a faster rate than that for the OECD average.

NETHERLANDS

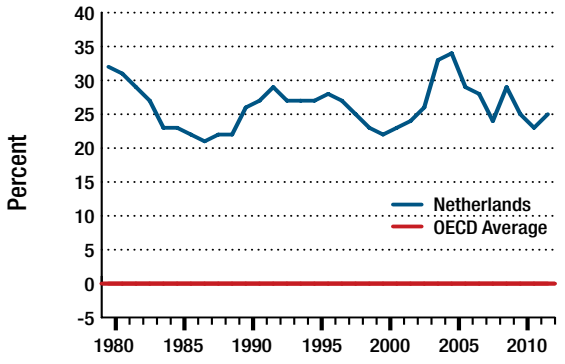
Energy Security Risk Summary: Netherlands

Risk Scores:	
2012 Energy Security Risk Score	1,312
2012 Large Energy User Group Rank	22
Score in Previous Year	1,384
Rank in Previous Year	22
Score in 1980	1,321
Average Score: 1980-2012	1,102
Best Energy Security Risk Score	955 (1999)
Worst Energy Security Risk Score	1,384 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	26%
Best Relative Score	21% (1987)
Worst Relative Score	34% (2005)

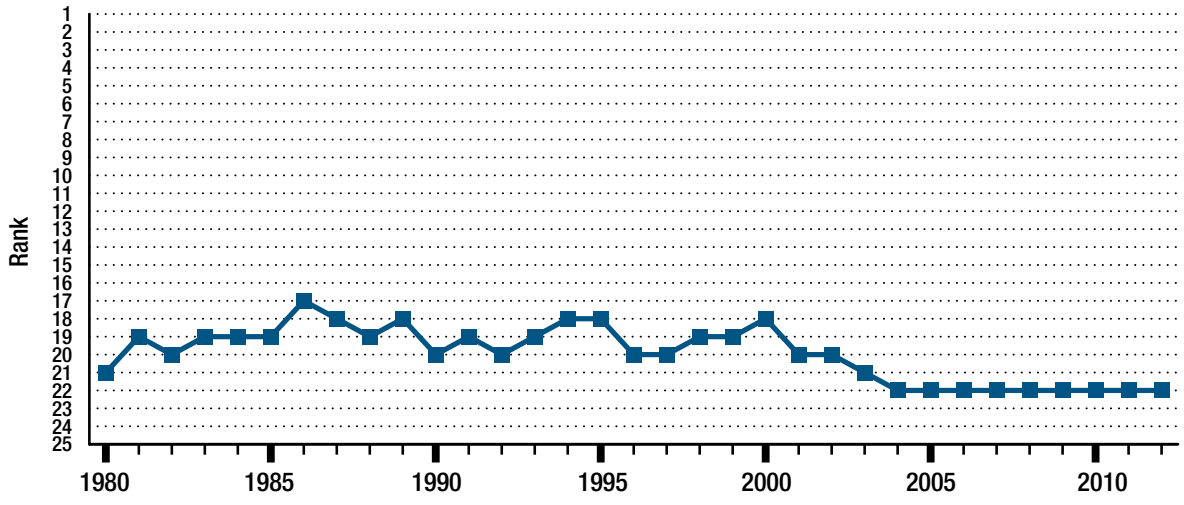
Netherlands vs. OECD: Risk Index Scores



Netherlands: Risk Variance from OECD



Netherlands: Risk Ranking



With a rank of 22, the Netherlands is the least energy secure of all the developed countries in the large energy user group and has been for many years. From 1980 to 2012, its overall risks were at least 22% above the OECD average. Nevertheless, over the years it total risk score, while relatively high, has moved largely in tandem with the OECD average, meaning that there is no visible trend in the Netherland's energy security risks in relation to the OECD average.

The Netherlands is a large producer and exporter of natural gas, most of which is produced onshore, and its natural gas import risk is much better than the OECD average. Although a producer of both oil and a coal, the country depends on imports of these fuels to satisfy domestic demand. The country has, for its size, a relatively large oil refining sector. It is among the world's largest net exporters of refined petroleum, which has helped keep its overall oil import risk lower than it would be otherwise. The Netherlands is also taking steps to tap into its relative large shale resources of oil and natural gas, which could lower future risks.

About 80% of the Netherland's electricity generation capacity is thermal--mainly gas-fired plants with some coal-fired plants. Renewables now make up about 15% of installed capacity. This heavy concentration of natural gas facilities, however, means that the Netherlands' capacity diversity is worse than the OECD average. Its retail electricity prices also are well above the OECD average, not surprising given the reliance on relatively expensive natural gas to produce electricity.

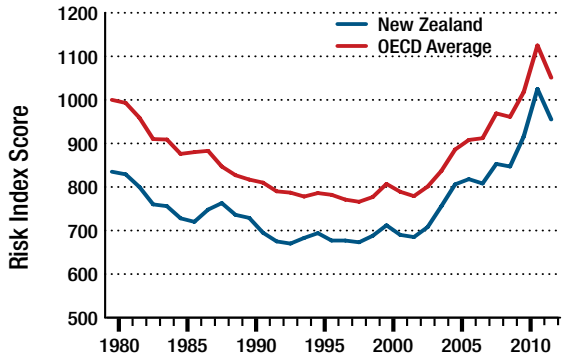
Overall energy usage is something of a mixed bag, with its energy intensity at about the OECD average and its per capita energy usage above the average. The country's transportation sector, however, generally has used less energy per dollar of GDP and less energy per person than the OECD, though these advantages are closing. This is especially the case with the amount of energy used per person in the transportation sector, which in 2012 was half again as large as the 1980 value.

NEW ZEALAND

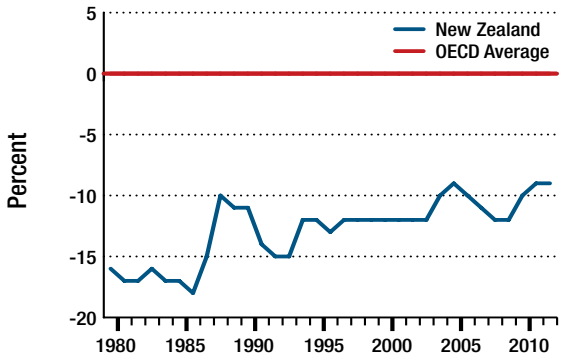
Energy Security Risk Summary: New Zealand

Risk Scores:	
2012 Energy Security Risk Score	955
2012 Large Energy User Group Rank	3
Score in Previous Year	1,025
Rank in Previous Year	3
Score in 1980	835
Average Score: 1980-2012	761
Best Energy Security Risk Score	670 (1993)
Worst Energy Security Risk Score	1,025 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	-13%
Best Relative Score	-18% (1986)
Worst Relative Score	-9% (2011)

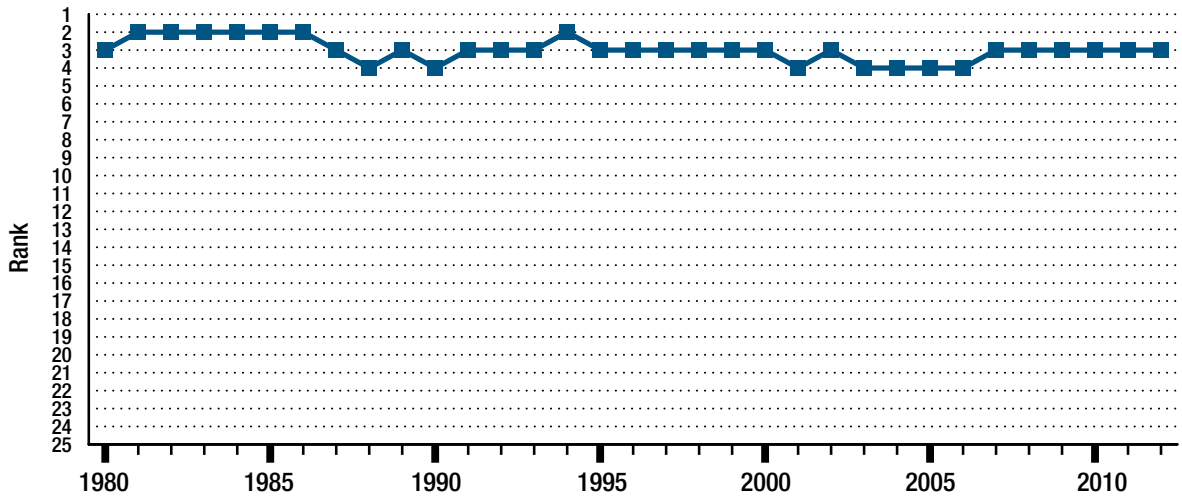
New Zealand vs. OECD: Risk Index Scores



New Zealand: Risk Variance from OECD



New Zealand: Risk Ranking



New Zealand's risk scores consistently have ranked in the top five of the large energy user group, rising to as high as two in the 1980s. Its 2012 score of 955 earns if a ranking of three, the same as in 2011. More recent trends suggest that New Zealand's energy security risks are worsening at a slightly faster rate than for the OECD as a whole. Absolute energy security risks also are moving higher and in 2012 were 120 points more than in 1980.

Fuels that cannot be produced domestically must be imported into this island nation aboard ships. It does not produce what would be considered large amounts of oil, natural gas, or coal, but its production of the latter two fuels are enough to satisfy domestic demand and, in the case of coal, to support an export trade. When set against the OECD average, New Zealand's import-related risk metrics compare favorably for coal and natural gas, and are pretty close to the OECD baseline for oil. It expenditures on energy imports are thus quite a bit better than the OECD average.

The power sector in New Zealand is dominated by hydroelectric power, which in 2012 accounted for more than half of generation, with natural gas and non-hydro renewables each accounting for nearly 20%. As a result, its electricity diversity is better than the OECD average. Over most of the period since 1980, New Zealand has benefited from relatively low electricity rates, but since 2004, that advantage appears to have been lost as rates have crept up to, and in some years slightly above, the OECD average.

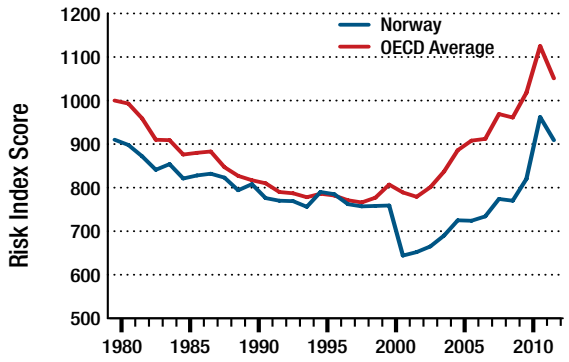
New Zealand also uses slightly more energy, both overall and in the transport sector, to generate a dollar's worth of GDP than the baseline of OECD countries. Its carbon dioxide emissions trend is also somewhat worse than the OECD average, but its emissions intensity and emissions per capita generally are in line OECD trends.

NORWAY

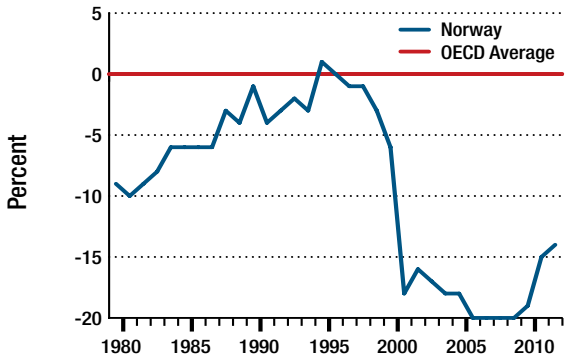
Energy Security Risk Summary: Norway

Risk Scores:	
2012 Energy Security Risk Score	909
2012 Large Energy User Group Rank	1
Score in Previous Year	962
Rank in Previous Year	1
Score in 1980	910
Average Score: 1980-2012	789
Best Energy Security Risk Score	644 (2001)
Worst Energy Security Risk Score	962 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	-9%
Best Relative Score	-20% (2006)
Worst Relative Score	1% (1995)

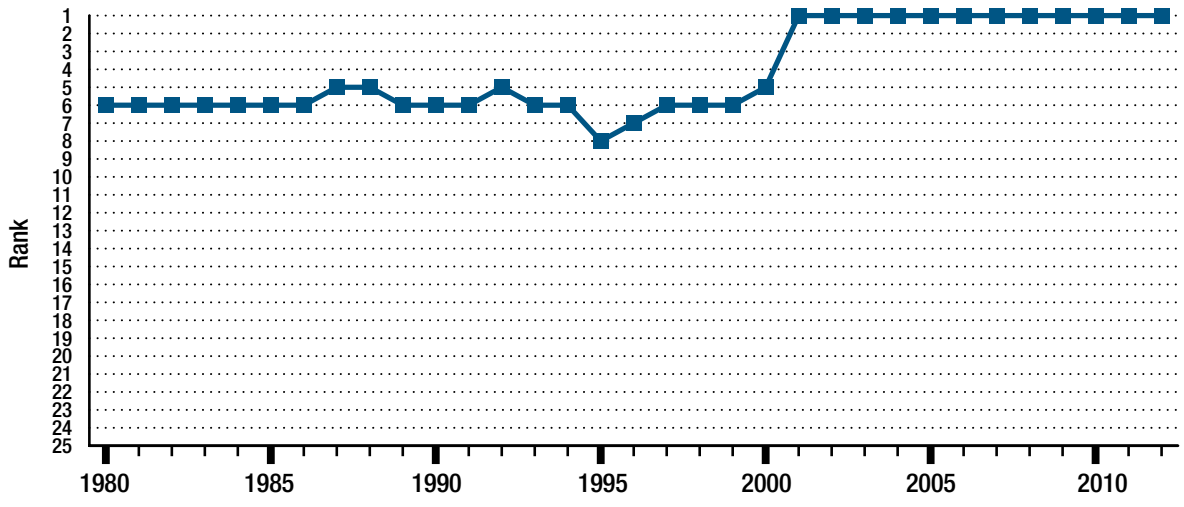
Norway vs. OECD: Risk Index Scores



Norway: Risk Variance from OECD



Norway: Risk Ranking



From 2000 to 2001, Norway's energy security ranking rose from five to one—a shift related largely to greater domestic coal production. Since then, it has consistently held the top spot. While it overall scores consistently have been much better than the OECD average since 2011 (from 14% to 20%), the country lost some ground in 2011 and 2012 because of increased risks associated with energy expenditures.

Norway is rich in energy resources and is a net exporter of all types of fossil fuels. Once an oil importer, Norway became an oil exporter as production from the North Sea began in earnest in 1975. In addition, Norway is one of the world's largest exporters of natural gas. Coal is used primarily for industrial purposes. With the opening of the Svea Norda mine on the island of Spitsbergen in the Svalbard archipelago, 2001, Norway became a net exporter of coal. Shipments from Spitsbergen are largely seasonal because winter ice blocks shipping routes. That means that Norwegian industries, which need a steady supply of coal for their operations, import coal from its European neighbors Poland, Russia, the United Kingdom, and Germany.

Given all of this, Norway scores very well in the fuel import measures compared to the OECD baseline. Stable and democratic, Norway also is a reliable supplier of fossil fuels to regional and global markets, and its production adds to the volume and diversity of fuel supplies. Both of these contribute to improving the energy security of all countries. Moreover, thanks in large part to its robust energy sector, Norway has the best per capita GDP score of the 25 countries in the major energy user group.

Where Norway scores poorest compared to the OECD baseline is in electricity capacity diversity. About 95% of the country's generation comes from hydroelectric facilities, which makes its electricity supply susceptible to drought-related interruptions. (Its score for non-carbon dioxide emitting generation is comparatively quite good, however.)

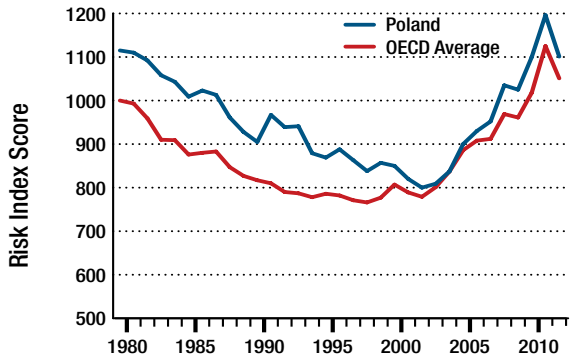
Its energy use per capita is also very high. In 2012, it was second highest after Canada. This is probably a reflection of the country's cold climatic conditions and the fact that its energy intensive industrial sector make up a relatively large portion of the country's economy. It carbon dioxide emissions metrics are about the same as the OECD average or a bit better.

POLAND

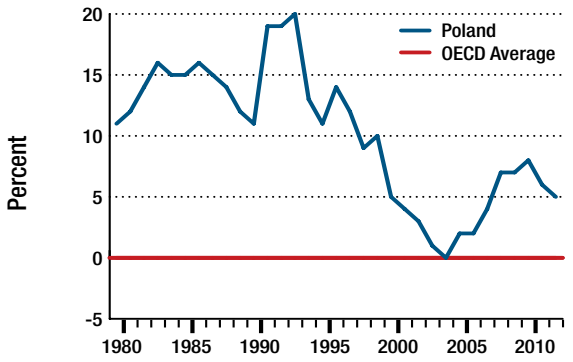
Energy Security Risk Summary: Poland

Risk Scores:	
2012 Energy Security Risk Score	1,101
2012 Large Energy User Group Rank	11
Score in Previous Year	1,196
Rank in Previous Year	11
Score in 1980	1,115
Average Score: 1980-2012	959
Best Energy Security Risk Score	800 (2002)
Worst Energy Security Risk Score	1,196 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	10%
Best Relative Score	0% (2004)
Worst Relative Score	20% (1993)

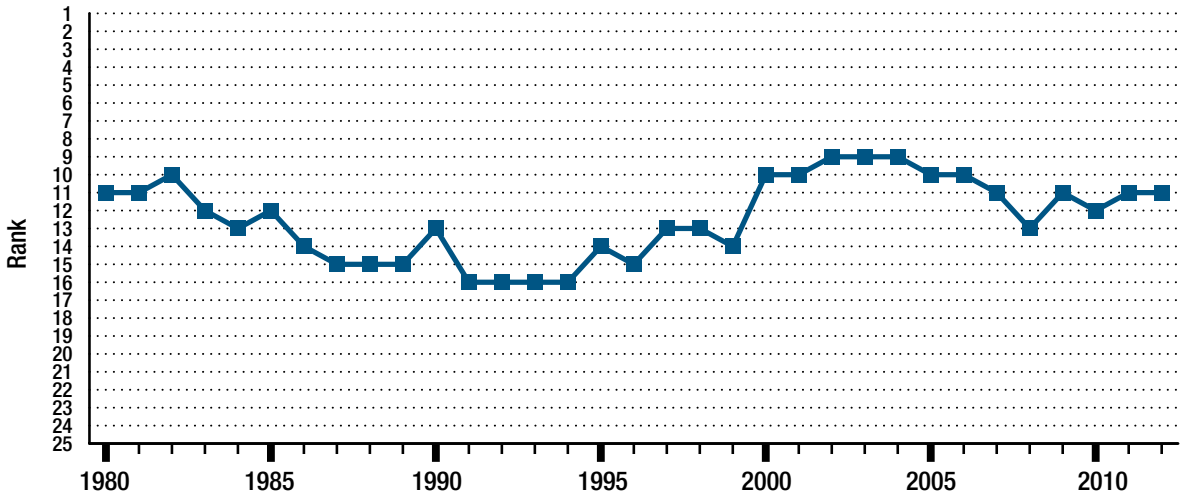
Poland vs. OECD: Risk Index Scores



Poland: Risk Variance from OECD



Poland: Risk Ranking



Of the three former Soviet Bloc countries, Poland displays the lowest energy security risk for most of the period from 1980 to 2012. From the early 1990s to the mid 2000s, in particular, Poland gained ground on its peers, and from 19% higher in 1991, its score in was just at the OECD average in 2004. Since then, however, the country has lost ground against the OECD. In 2012, it ranked number 11 with a score of 1,101. As an economy in transition, Poland faces significant energy challenges related to energy use, expenditures, and prices.

Poland has a large coal resource and is one of the world's largest producers of that fuel. About 85% of its electric power, and well more than half of its overall energy consumption, comes from coal. Domestic production has been sufficient to meet demand over almost all of the period since 1980.

With very limited supplies of other fuels—Poland produces modest amounts of natural gas and negligible amounts of oil and has to import large amounts of these fuels—coal represents a secure domestic supply of very affordable energy, and it is a source of many jobs in the mining sector. Coal mining is still done largely by state-owned firms, but the government plans to privatize most if not all of its coal-mining assets. Coal supply and demand are in tight balance, and Poland could become a new importer of this fuel in the near future.

Poland relies on imports for much of it oil and natural gas, and most of these imports—more than 90% of oil and 80% of natural gas—come from Russia. Poland is looking at diversifying its supplies of natural gas and is constructing an LNG facility in the Baltic city of Swinoujscie. Domestic shale gas offers another option. EIA estimates that Poland, which has only 3 trillion cubic feet of recoverable natural gas reserves on the books, has potentially as much as 148 trillion cubic feet of shale gas, though the country's geology is quite challenging. (This resource estimates reflects a downward revision by EIA following exploration results that were lower than expected.) With an estimated 105 trillion cubic feet, Poland's largest shale resource is located in the Baltic Basin in northern Poland. While initial test wells in Poland have been disappointing, more recent tests suggest reasons for cautious optimism. In addition to the challenging geology, there are significant regulatory and infrastructure that need to be addressed to accelerate shale exploration and development.

The almost complete reliance on coal for generating electricity has kept Polish electricity prices well below the OECD average for most of the period, but since the mid-2000s, this advantage has dwindled. Given the large dominance of coal, it is not surprising that Poland's electricity diversity scores compare unfavorably to the OECD average. Poland's energy policy to 2030 proposes diversification of the electricity generation by introducing nuclear energy. Renewables also are being encouraged by setting up a feed-in tariff. The addition of nuclear and renewables should improve Poland's share of non-carbon generation in the power sector.

Polish energy demand is expected to increase as its economy grows and develops. Its energy use measures are typical for a country undergoing a transition to a market-based economy. While its energy use per capita scores, overall and in the transport sector, are better than the OECD average for these, its energy intensity scores are worse, though the gap has been getting smaller.

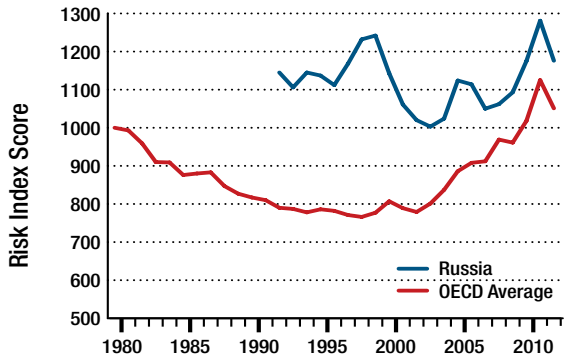
Poland's carbon dioxide emissions are still comparatively better than the OECD baseline, reflecting Poland's economic transition, though its carbon dioxide emissions intensity is high by OECD standards. The Polish government has taken a keen interest in carbon capture and storage technologies as a way to help reduce emissions from its power sector.

RUSSIAN FEDERATION

Energy Security Risk Summary: Russian Federation

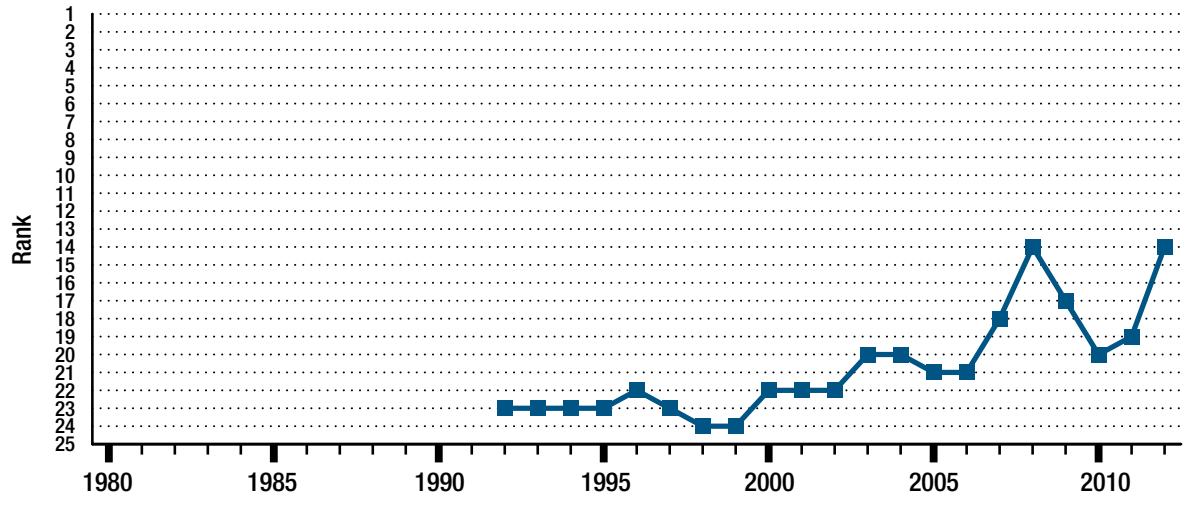
Risk Scores:	
2012 Energy Security Risk Score	1,176
2012 Large Energy User Group Rank	14
Score in Previous Year	1,281
Rank in Previous Year	19
Score in 1980	1,145
Average Score: 1980-2012	1,124
Best Energy Security Risk Score	1,003 (2003)
Worst Energy Security Risk Score	1,281 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	32%
Best Relative Score	10% (2008)
Worst Relative Score	61% (1998)

Russian Federation vs. OECD: Risk Index Scores



Russian Federation: Risk Variance from OECD

Russian Federation: Risk Ranking



Despite very large energy resources, the Russian Federation's energy security risks have over the years been much higher than its peers in the large energy user group. In 1992 (the first year for which Russian data are available), the country's energy security was ranked third from the bottom. Since 1999, when its risk score was 60% higher than the OECD average, its relative risk scores have declined steadily to just 12% above the OECD in 2012, when it achieved its best rank of 14.

Russian fossil fuel reserves, estimated by CRS at 955 billion barrels of oil equivalent, are second only to the United States, and it is a leading producer of all types of fossil energy. More than 60% of this is in coal, and about 30% in natural gas. Undiscovered oil and natural gas could add another 323 billion barrels of oil equivalent to Russia's total.

Energy exports contribute greatly to Russia's economy. In 2012, Russia was the world's largest producer of both crude oil and gas, and the sixth largest producer of coal. Its production of these fuels is well in excess of domestic demand, and it is a large net exporter of all of them as well as refined petroleum products. It is no surprise, then, that its import-related energy security risks are well below the OECD average.

Russia also has very large unconventional resources. EIA estimates technically recoverable reserves of 287 trillion cubic feet of natural gas (in addition to huge conventional reserves 1,688 trillion cubic feet) and 75.8 billion barrels of oil. Most of the oil resource is in Siberia's Bazhenov formation, which some analysts believe could contain as much as 100 billion barrels of recoverable oil, which would make it one of the largest shale oil plays in the world.

Although Russia's large volume of fossil fuel exports boosts the diversity of global and regional fossil fuel supplies, its low scores for political and civil liberties make it a potentially unreliable trading partner. Indeed, with the largest proved natural gas reserves in the world, Russia has not been shy about using its clout to influence markets in Europe, which depends on Russia for much of much of its gas supplies. Moreover, Russia, Iran, and Qatar began discussing forming an OPEC for gas-exporting countries. Today, however, it is unclear how influential this group might become, although its individual members still wield considerable market power regionally. It is much more difficult to emulate an oil cartel with natural gas. Storing, liquefying, and shipping natural gas is a much more expensive and technically complex undertaking than storing and shipping crude oil. Natural gas markets are facilitated mostly by pipeline and are regional. A global natural gas cartel based on LNG, therefore, unlikely to gain much traction, especially if new unconventional natural gas resources can be developed in countries where they are plentiful.

Russia's power sector is fairly diverse. About half of its power generation capacity produced from natural gas. The remainder is pretty evenly split among hydropower, coal, and nuclear plants. To allow for greater exports of natural gas, Russia is planning to increase coal production and build more coal-fired power plants.

About the only other area where Russia is well ahead of the OECD average is in transportation energy use per person. This is not surprising given Russia's well developed public transportation system, but this edge is beginning to shrink, will probably be continue to do so as Russia's economy develops further and more people purchase vehicles.

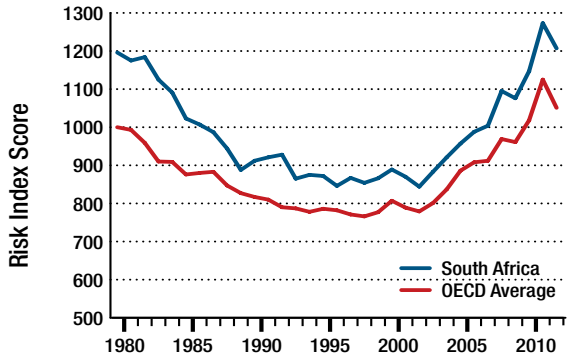
After decades of communist rule, Russia's economy remains very inefficient. All of the country's energy and carbon dioxide emissions intensity measures show higher risks compared with the OECD average, and in some cases much higher. Russia has the second worst energy intensity measure of any country in the large energy user group (the Ukraine's is the worst). Russia's intensity measures, however, all show large improvement compared to the OECD average, but at more than 400% above the average in 2012, there is still tremendous room for improvements.

SOUTH AFRICA

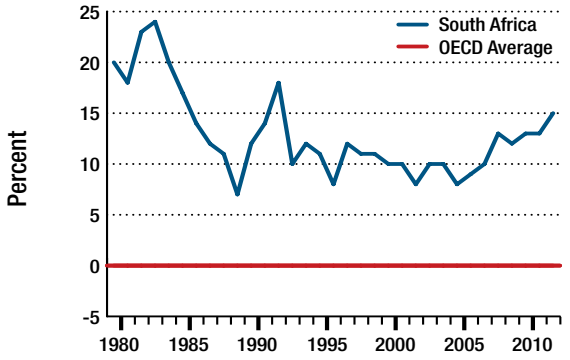
Energy Security Risk Summary: South Africa

Risk Scores:	
2012 Energy Security Risk Score	1,207
2012 Large Energy User Group Rank	16
Score in Previous Year	1,273
Rank in Previous Year	16
Score in 1980	1,196
Average Score: 1980-2012	987
Best Energy Security Risk Score	844 (2002)
Worst Energy Security Risk Score	1,273 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	13%
Best Relative Score	7% (1989)
Worst Relative Score	24% (1982)

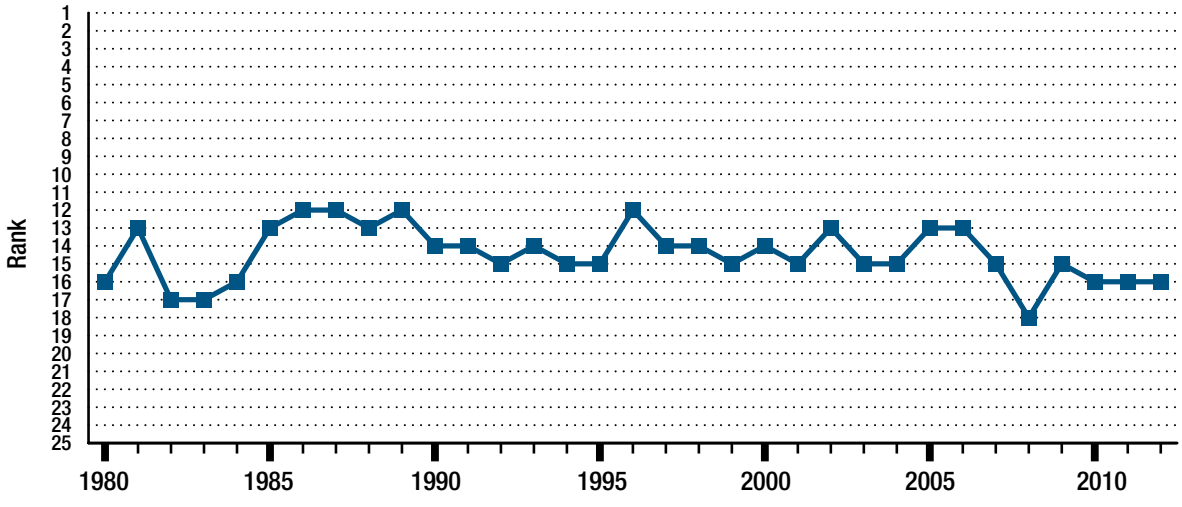
South Africa vs. OECD: Risk Index Scores



South Africa: Risk Variance from OECD



South Africa: Risk Ranking



South Africa's energy security risk consistently has been higher than the OECD average for the entire period from 1980 to 2012, ranging from 24% to 8% higher. Its score for 2012 of 1,207, earning it a ranking of 16, is essentially unchanged from its 1980 score. Trends over the past few years suggest that the county's energy security risks relative to the OECD average improved rapidly from the early 1980s to1990. Since 2005, however, its risks appear to be growing relative to its peers. The country's scores for individual measures of risk exhibit many of the drawbacks one would expect to see in a large emerging economy, but it also has advantages some other emerging economies lack, such as large energy resources.

South Africa, the wealthiest country in Africa, is rich in coal. Its reserves and production are the sixth and seventh largest in the world, respectively. It is a major exporter of coal to Europe, China, and India. The country also has the world's only commercial coal-to-liquids facility, and it produces about 150,000 barrels per day of liquids, a substantial portion of South Africa's liquids demand of about 550,000 barrels per day. More coal-to-liquids capacity is being planned. The country has relatively small proved reserves of oil, located primarily offshore, and natural gas, so it relies on imports to meet demand for these products. 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.

South Africa's coal-to-liquids capability has enhanced its energy security by lessening its oil import exposure risk, which is about a about equal to the OECD average. Its natural gas import risks, however, have worsened quite a bit since 2006 due to greater imports. The recent increase in natural gas imports was primarily responsible for the rise in the amount of money the country spends on fossil fuel imports as a share of GDP relative to the OECD baseline.

About 75% of the population has access to electricity, and access is much higher (88%) in the cities. About 12.5 million people have no access to electricity. With such an abundance of coal, it is no surprise that coal dominates the power sector, accounting for about 95% of generation. A huge 4.8 gigawatt coal-fired power station at Medupi is should come online in 2013, and a new 4.8 gigawatt plant in Kusile is expected to be completed by 2021. Most of the remaining electricity demand is supplied by nuclear power (a planned 3.5 gigawatt nuclear power plant has been delayed for financial reasons). Hydropower and pumped storage also contribute very small amounts. The predominance of one fuel in the power sector means that South Africa's capacity diversity risk measure is much higher than the baseline of OECD countries.

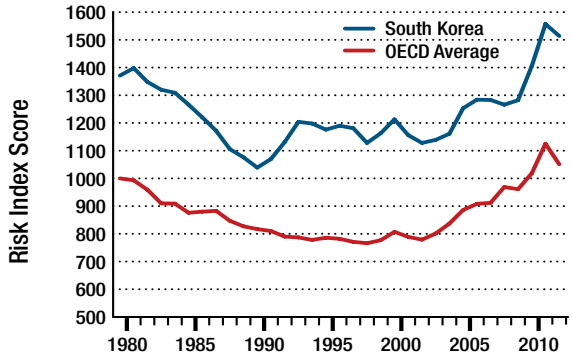
Most of the emerging economies in our large energy user group consume energy less efficiently than the OECD average and are increasing their carbon dioxide emissions rapidly, and South Africa is no exception. In addition to a growing middle class, the country has a large mining sector and other industries that use large amounts of energy. While energy use and emission risk measures in South Africa have improved more slowly, if at all, against the OECD baseline.

SOUTH KOREA

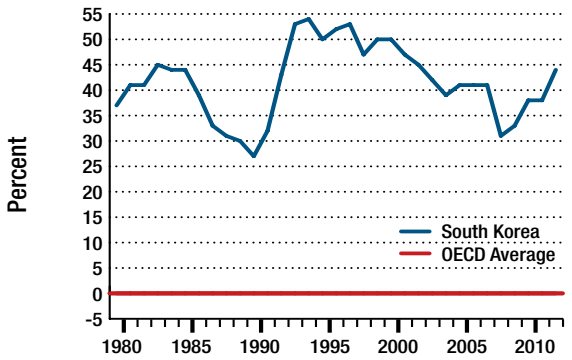
Energy Security Risk Summary: South Korea

Risk Scores:	
2012 Energy Security Risk Score	1,514
2012 Large Energy User Group Rank	23
Score in Previous Year	1,557
Rank in Previous Year	23
Score in 1980	1,371
Average Score: 1980-2012	1,233
Best Energy Security Risk Score	1,039 (1990)
Worst Energy Security Risk Score	1,557 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	42%
Best Relative Score	27% (1990)
Worst Relative Score	54% (1994)

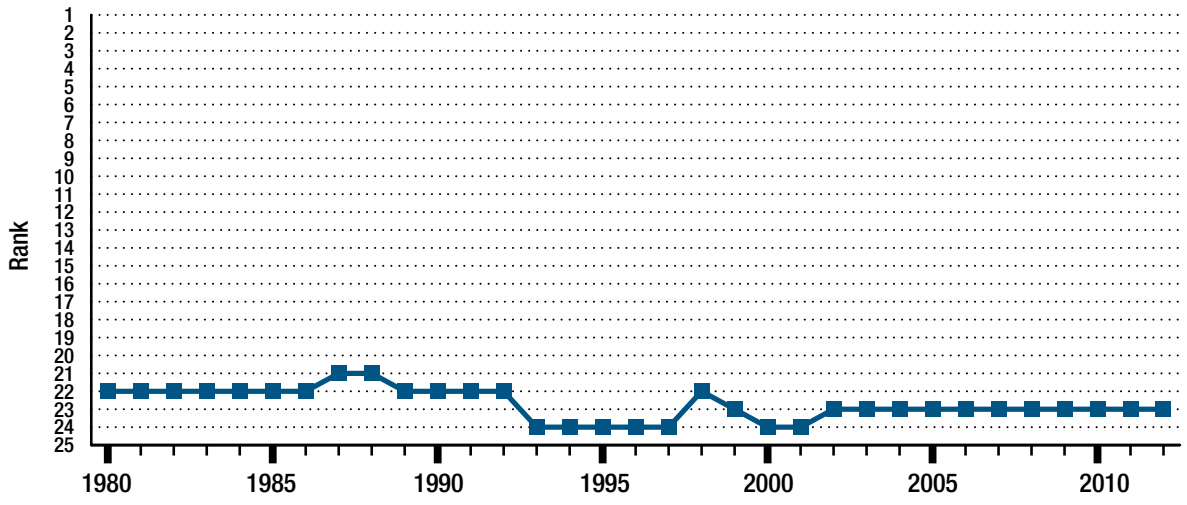
South Korea vs. OECD: Risk Index Scores



South Korea: Risk Variance from OECD



South Korea: Risk Ranking



With an energy security risk score greater than 1,500, South Korea was the third least energy secure country in the large energy user group in 2012 (ahead of only Thailand and the Ukraine). Since 1990, South Korea's scores consistently have placed it among the three most energy insecure countries in the group. For the entire period from 1980 to 2012, South Korea's total energy security risk scores were on average 42% higher than the OECD average. Only the Ukraine had worse average scores over the period.

South Korea is one of the world's largest energy importers. It produces a negligible amount no crude oil (about 1,000 barrels per day) and small amounts of coal and natural gas (equivalent only to about 2% of domestic needs). It is the world's second largest importer of LNG behind Japan and third largest coal importer behind Japan and China.

As a result, all of Korea's import exposure metrics—for oil, natural gas, coal, and total energy—are worse than the comparable OECD baseline scores. Many South Korean energy companies, both state-owned and private, conduct exploration and production operations overseas to mitigate these risks.

Korea's power sector is fairly diverse, with risk measures of power sector diversity and non-carbon emitting generation being comparable to the OECD average. About 45% of electricity generation is from coal, 30% from nuclear, and 20% from natural gas. Since 1980, the country has added about 17 gigawatts of nuclear capacity, and its 20 nuclear reactors account for about one-fifth of total generating capacity. The replacement of large amounts of natural gas-fired capacity with nuclear capacity from 1985 to 1990 led to a sharp drop in Korea's natural gas exposure risk, which led to a large drop in overall risk. Greater imports of coal for power generation in the subsequent five years, however, offset much of the reduction in risk brought about by lower gas imports. Energy expenditures and retail electricity rates, however, are two areas where Korea has a clear edge over the typical OECD country. The lower costs associated with coal and nuclear power generation have helped offset generation from high-priced natural gas.

South Korea's intensity measures—these cover total energy, petroleum, transportation energy, and carbon dioxide emissions—are higher than their OECD averages, and the trends for many of these since 1980 indicate no improvement, and in some cases a worsening, relative to the OECD baseline.

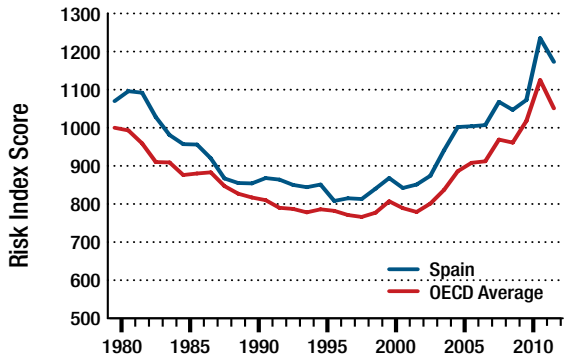
Per capita measures of energy use, transportation energy use, and carbon dioxide emissions are three areas where Korea scored better than the OECD average for most of the period. However, as Korea has developed, the trend in these has been towards higher risks, and two of these—per capita energy use and per capita carbon dioxide emissions—are now higher than the OECD baseline scores. And as one would expect, total carbon dioxide emissions are growing along with the economy.

SPAIN

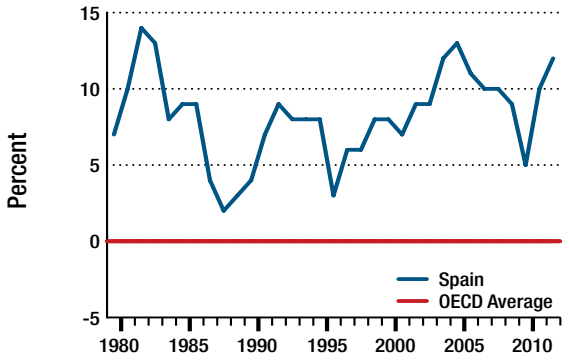
Energy Security Risk Summary: Spain

Risk Scores:	
2012 Energy Security Risk Score	1,173
2012 Large Energy User Group Rank	13
Score in Previous Year	1,235
Rank in Previous Year	13
Score in 1980	1,070
Average Score: 1980-2012	946
Best Energy Security Risk Score	808 (1996)
Worst Energy Security Risk Score	1,235 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	8%
Best Relative Score	2% (1988)
Worst Relative Score	14% (2005)

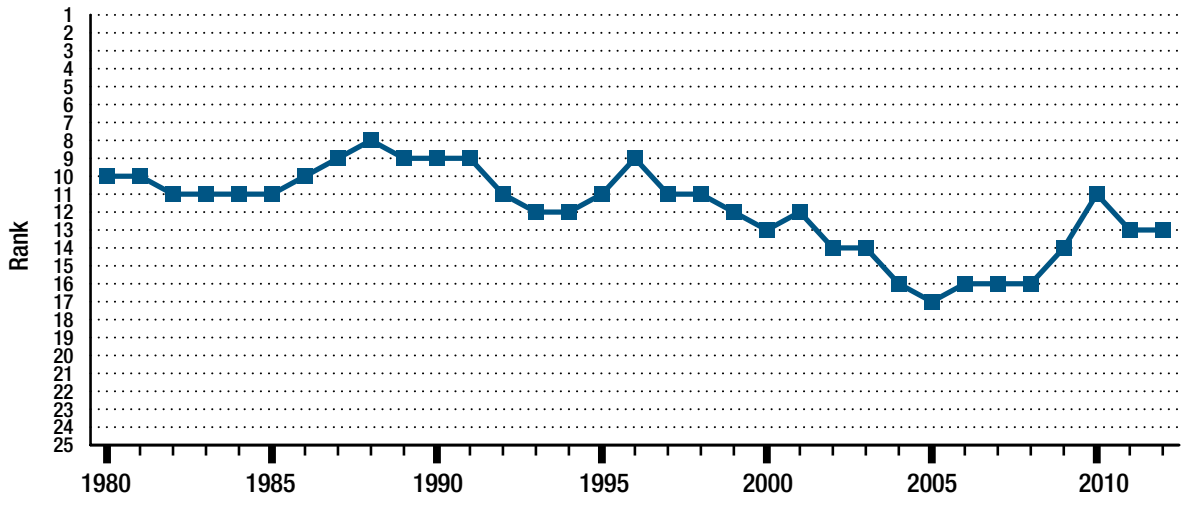
Spain vs. OECD: Risk Index Scores



Spain: Risk Variance from OECD



Spain: Risk Ranking



Spain's overall energy security risks have been consistently higher than the OECD group average for the entire period from 1980 to 2012. Its 2012 score of 1,173 places at number 13 in our ranking, the same spot it held in 2011. It best ranking of eight was achieved in 1988, when its risk score was just 2% above the OECD average. Since then, the gap with the OECD has widened in fits and starts, and in 2012 it was 12% higher.

Spain produces almost no oil or natural gas and little coal, so it must import large quantities of these fuels to meet domestic demand, which has increased significantly since the early 1990s. Spanish law caps the share of oil or natural gas imported from any single source country as a way to maintain supply diversity. Natural gas imports are largely from Algeria, primarily but not exclusively by pipeline. In 2011, the 280 billion cubic feet capacity Medgaz natural gas pipeline from Beni Saf port in Algeria to Perdigal Beach in Spain was opened. A 425 billion cubic feet Maghreb-Europe pipeline also serves Spain. In addition, Spain has seven LNG facilities, and it is the third largest importer of LNG (after Japan and South Korea). As a result of its large imports, its fossil fuel import risks are well above those for the OECD average, as is the amount it pays for these imports as a share of GDP.

The diversity of Spain's electricity has improved over the years and is better than the OECD baseline. In the early 1980s, its chief sources of power were from oil, coal, and hydro. In the mid 1980s, Spain began adding nuclear capacity, and by the end of the decade, it accounted for roughly 16% of capacity and more than one-third of power generation. The increasing availability of Algerian gas in the mid to late 1990s also led to construction of gas-fired capacity. Feed-in tariffs also have encouraged renewable builds. Since 2000 non-hydro renewable capacity has climbed from 5% to 25% (though its share of output is much smaller). While the diversity of Spain's power sector is an asset, its electricity prices are higher than the OECD average. Moreover, citing the excessive costs, the government announced deep (and retroactive) cuts to renewable subsidies, which are expected to slow renewable capacity additions in the future and even affect existing capacity.

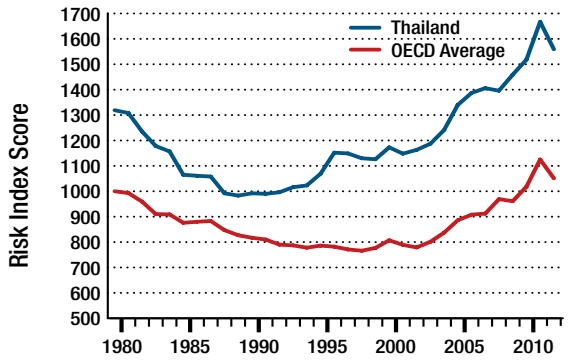
Spain scores relatively well in the energy use risk categories. It has a smaller energy intensity score than the OECD average, and this has helped moderate the impact of rising energy costs. These energy intensity metrics, however, are not improving at the same rate as the OECD average. Meanwhile, its carbon dioxide emissions have grown faster than the OECD average while its emissions intensity and emissions per capita metrics are a little better than the OECD baseline.

THAILAND

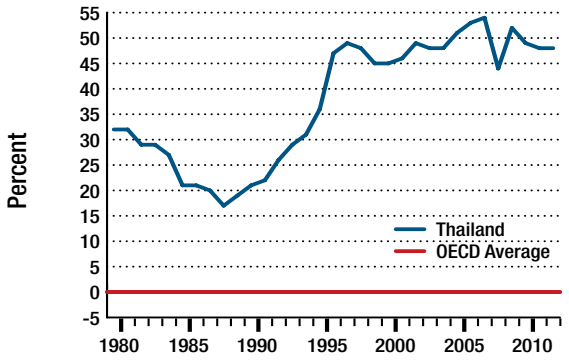
Energy Security Risk Summary: Thailand

Risk Scores:	
2012 Energy Security Risk Score	1,564
2012 Large Energy User Group Rank	24
Score in Previous Year	1,673
Rank in Previous Year	24
Score in 1980	1,312
Average Score: 1980-2012	1,200
Best Energy Security Risk Score	977 (1989)
Worst Energy Security Risk Score	1,673 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	37%
Best Relative Score	17% (1988)
Worst Relative Score	54% (2007)

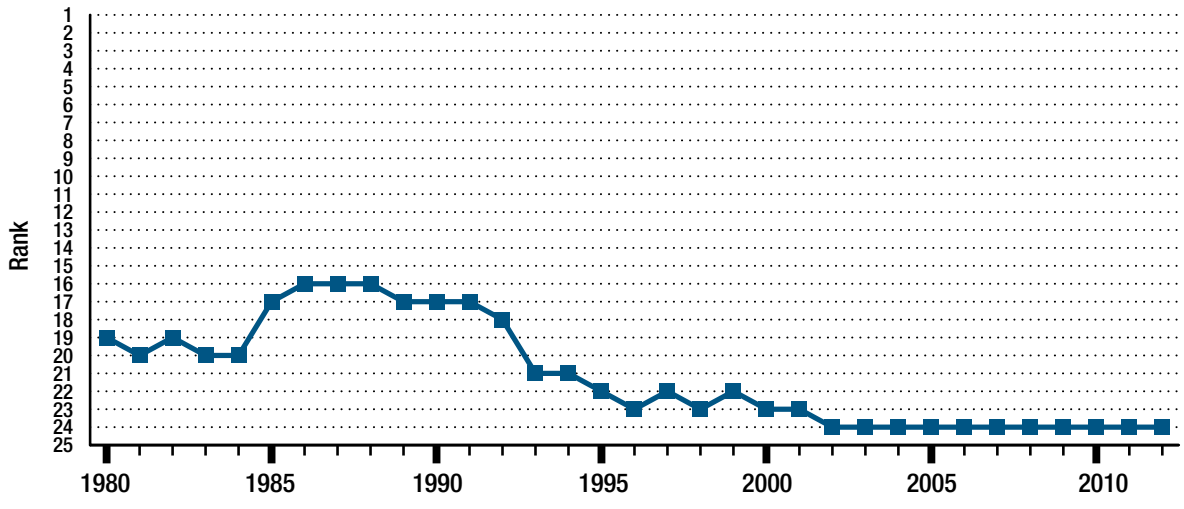
Thailand vs. OECD: Risk Index Scores



Thailand: Risk Variance from OECD



Thailand: Risk Ranking



In 2012, Thailand's energy security risk score was the second worst of the large energy user group, as it has been since 2002. During the 1980s, Thailand's total energy security risks improved rapidly, dropping more than 300 points, and its 1988 ranking of 16 was its best in the record. The 1990s, however, saw it risks growing sharply, both absolutely and relative to the OECD baseline. In 2012, its total risk score was more than 200 points higher than its 1980 score.

Thailand produces less than one-third of the oil it consumes and relies heavily on imports, making it the second largest net importer of oil in Southeast Asia. The country is also a relatively large producer of natural gas, almost all of which comes from fields in the Gulf of Thailand. Growing domestic production, however, has not been enough to meet the growth in demand. EIA estimates that technically recoverable reserves of shale gas could add another 5 trillion cubic feet of gas to present proved reserves of 10 trillion cubic feet, which if exploited successfully could add significantly to the country's production. Thailand also produces substantial amounts of coal—it is ranked second in Southeast Asia after Indonesia—but relies on imports to supplement domestic production, mainly for industrial purposes.

IEA's forecast for Southeast Asia suggests that imports of oil and natural gas could both approach if not exceed 90% of domestic demand by 2035, which would raise Thailand's import risks. The country also spends a much higher amount on imported fuels as a share of GDP than the OECD as a whole, and this IEA forecast would further exacerbate this trend.

In 2012, about 90% of Thailand's electricity generating capacity was conventional thermal. Oil capacity has been largely replaced by natural gas-fired capacity, which is responsible for about 75% of the country's electricity generation. Coal-fired plants account for another 20% of generation, with the most of the remainder coming from hydroelectric capacity and biomass and biogas. Because of the government's concerns about the country's natural gas supplies, IEA expects that coal's share of power production will rise to 36% by 2035. The government also is considering adding some nuclear capacity as a way to diversify its power sector, but after the Fukushima incident, plans have been scaled back, from 5 gigawatts to 2 gigawatts by the mid 2020s. Feed-in tariffs also are being used to promote renewables. The cost of electricity is one of the few areas where Thailand appears to compare favorably with the OECD as a whole, but the data are not as robust as one would like.

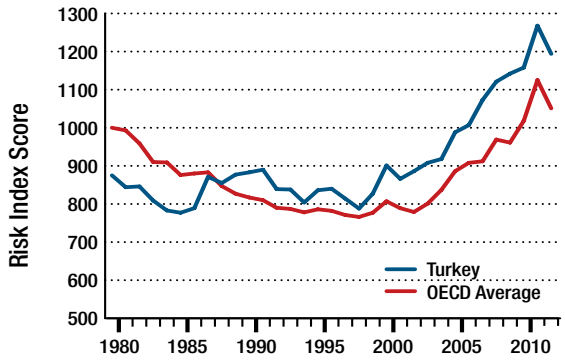
Thailand's energy intensity risk metrics—total energy, oil, and transportation energy—and carbon dioxide intensity metrics are all higher than the OECD averages. And while the metrics measuring energy use and emissions per person compare favorably to the OECD, the difference between them and their comparable OECD averages are shrinking as greater prosperity takes hold, a pattern other emerging economies show.

TURKEY

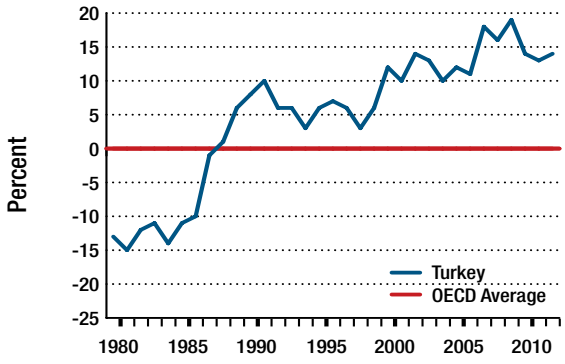
Energy Security Risk Summary: Turkey

Risk Scores:	
2012 Energy Security Risk Score	1,194
2012 Large Energy User Group Rank	15
Score in Previous Year	1,268
Rank in Previous Year	15
Score in 1980	875
Average Score: 1980-2012	913
Best Energy Security Risk Score	777 (1985)
Worst Energy Security Risk Score	1,268 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	5%
Best Relative Score	-15% (1981)
Worst Relative Score	19% (2009)

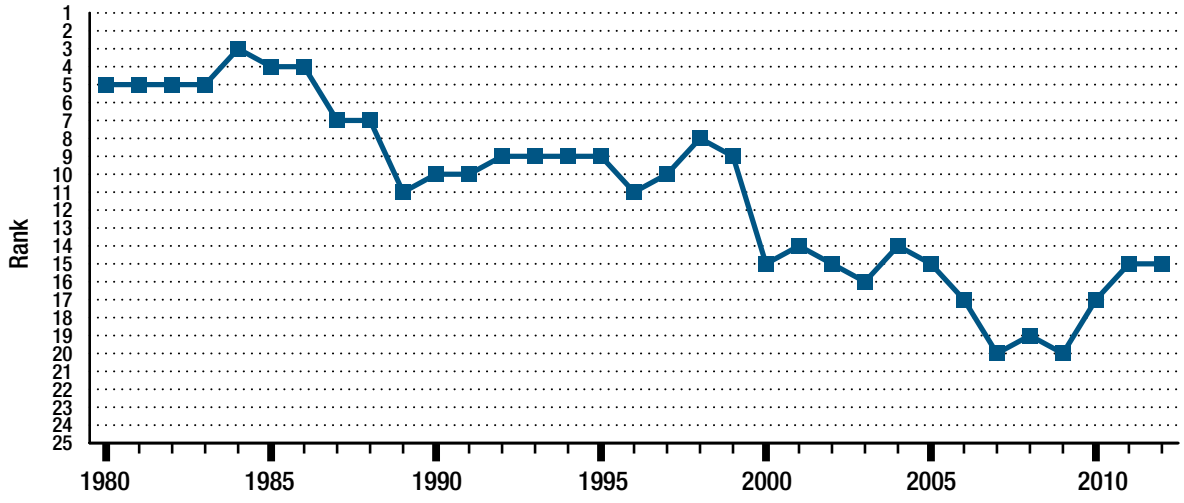
Turkey vs. OECD: Risk Index Scores



Turkey: Risk Variance from OECD



Turkey: Risk Ranking



Turkey's overall energy security risks from 1980 to about 2000 fairly stable. Since 2000, the country's risk scores have risen rapidly, and its 2012 was 300 points above its 1980 score. These trends are seen in the large change in Turkey's energy security ranking within the large energy user group: In 1980, it was ranked number five (it was number three in 1984); in 2012, it ranked number 15. The deterioration in Turkey's energy security has occurred almost completely across the board, and the gap between it and the OECD average appears to be widening.

Turkey is positioned as a strategic crossroads for energy. It not only is a major transit point for the ocean-going oil trade, but the pipelines that crisscross the country are increasingly important in the movement of oil and natural gas from the Caspian region to Europe.

Turkey produces very little oil and natural gas, and while it is the world's twelfth largest coal producer, it doesn't produce enough of any of these to satisfy domestic demand. Turkey's import exposure risks, therefore, are higher than the OECD average for all fuels, especially for natural gas. In 1987, Turkey became a net importer of natural gas, and since 1990, it has significantly increased its coal imports. These shifts have had a big impact on Turkey's energy security and are clearly seen in the shifting trends in the country's overall risk scores.

EIA reports that Turkey could have as much as 24 trillion cubic feet of technically recoverable shale gas that if realized would represent a dramatic increase over the current reserve estimate of about 0.2 trillion cubic feet. Turkey also is looking at potentially large reserves of natural gas offshore. In addition, EIA estimates Turkey holds 4.7 billion barrels of technically recoverable shale oil (compared to existing proved reserves of 270 million barrels).

Generating capacity in Turkey's power sector is divided between conventional thermal capacity (about two-thirds of the total) and hydroelectric capacity (about one-third). Natural gas-fired facilities account for about 45% of Turkey's electricity production, coal about 30%, and hydroelectric more 25%. Turkey has no nuclear reactors, but the government has said its goal is to build 20 reactors by 2030 to reduce Turkey's natural gas and oil imports. Once a big advantage, retail electricity prices in Turkey have been trending worse than the OECD average since 2008.

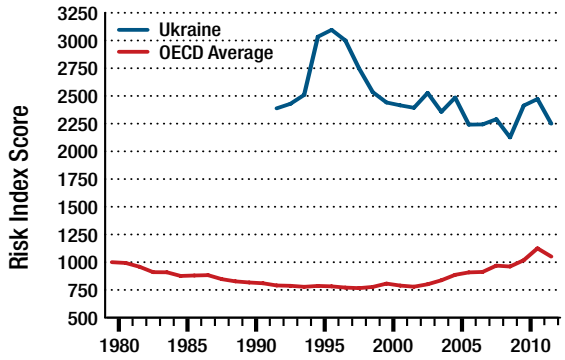
As one would expect to see in a rapidly growing emerging economy, the various energy intensity and carbon dioxide emissions measures also are worse than their corresponding OECD averages, but unlike a lot of other emerging economies, these metrics are not improving vis-à-vis the OECD baseline. Moreover, even those aspects of Turkey's energy security that are relatively better than the OECD average are moving in the wrong direction. Per capita energy and carbon dioxide emissions all have been below the OECD average for all or a good portion of the period from 1980 to 2010, but over the years these advantages relative to the OECD baseline have eroded.

UKRAINE

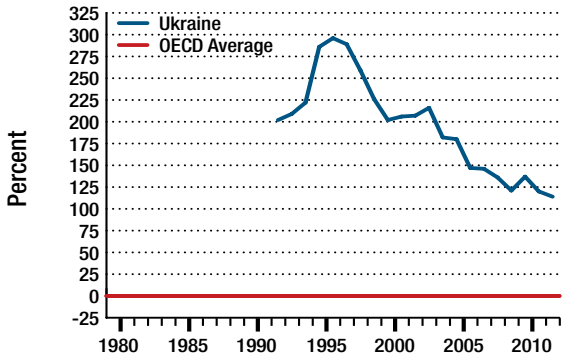
Energy Security Risk Summary: Ukraine

Risk Scores:	
2012 Energy Security Risk Score	2,250
2012 Large Energy User Group Rank	25
Score in Previous Year	2,472
Rank in Previous Year	25
Score in 1980	2,388
Average Score: 1980-2012	2,495
Best Energy Security Risk Score	2,126 (2009)
Worst Energy Security Risk Score	3,096 (1996)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	195%
Best Relative Score	114% (2012)
Worst Relative Score	296% (1996)

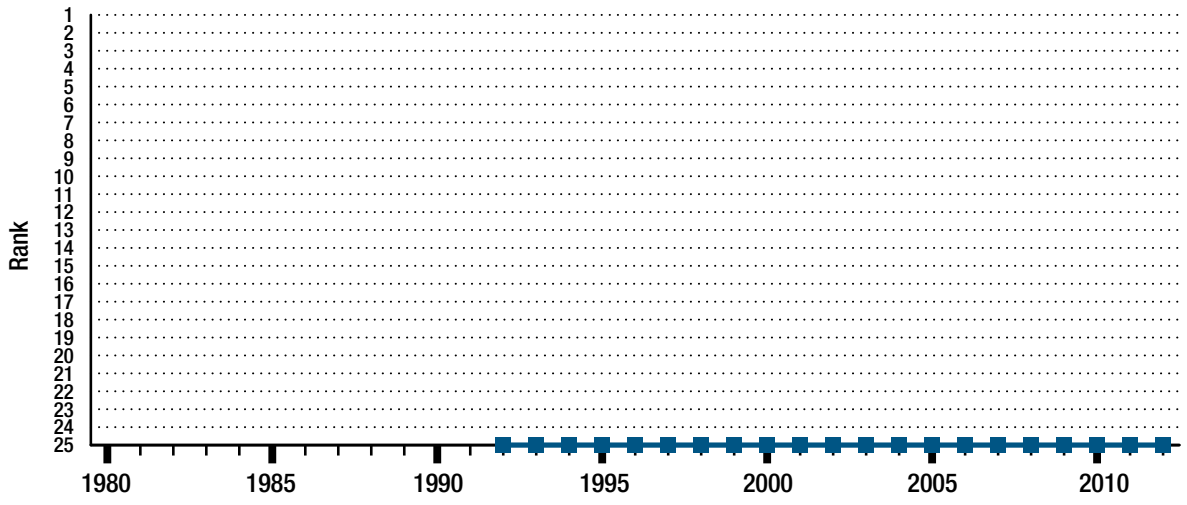
Ukraine vs. OECD: Risk Index Scores



Ukraine: Risk Variance from OECD



Ukraine: Risk Ranking



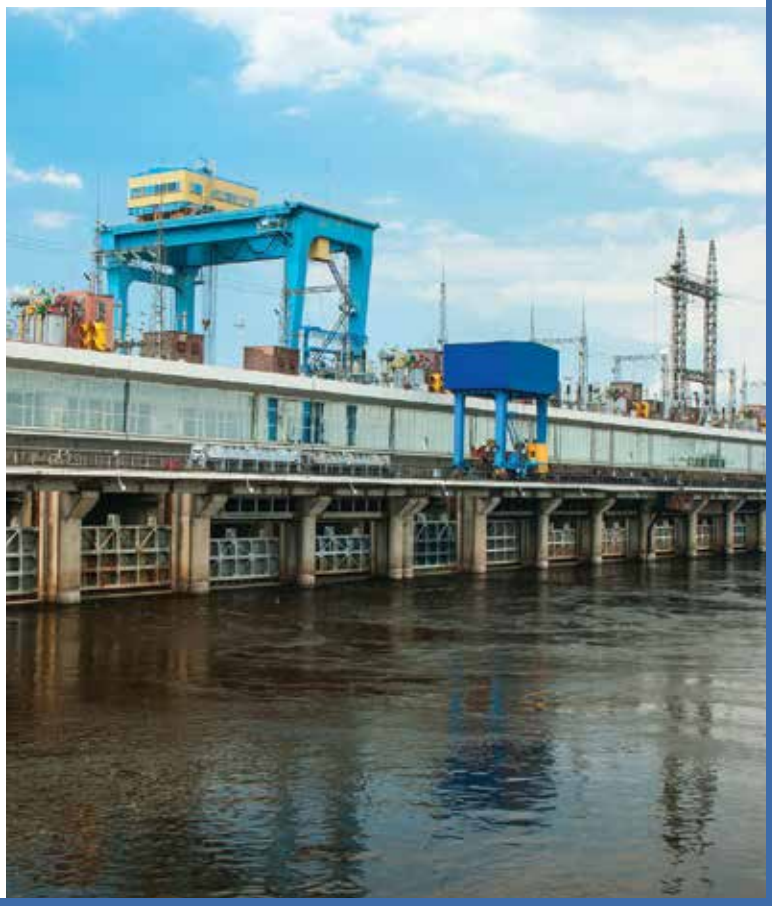
Since 1992, Ukraine has had by far the worst energy security index scores of any country in the large energy user group, both nominally and compared to the OECD. Its scores over the period averaged about 195% higher than those for the OECD. As net importer of oil, natural gas, and coal, Ukraine energy import and expenditure risk scores are poor, and its energy use is very inefficient. However, Ukraine's overall risk has been trending downward. From its peak of 3,096—296% above the OECD average—in 1996, the country's total risk score fell to 2,250 in 2009—still 114% above the OECD average but a considerable improvement. Recent trends suggest further gains.

Ukraine produces oil, natural gas, and coal, though not enough of any of these fuels to be self sufficient, and its import risks for everything except coal have been higher than the OECD average for most of the period since 1992. As a result, the country's expenditure of fossil fuels imports as a share of GDP have over the years been much higher than the OECD average. Nevertheless, most of Ukraine's import metrics (again, except for coal) have shown improvement over the last 10 years.

Ukraine has plentiful domestic coal supplies. It ranks seventh in the world in reserves and 14th in production. The country is self-sufficient in thermal coal, but must import metallurgical coal. Coal mining in Ukraine, however, is very inefficient and largely unprofitable. Nearly 70% of mines are state-run. A 2012 law will open up the country's coal sector to private investors, and 45 coal mines are slated for privatization in hopes that coal production can be increased.

Ukraine imports about 60% of its natural gas supply from Russia, and since 2006, Russia has cut supplies to the Ukraine twice. Ukraine, therefore, is seriously concerned about its energy vulnerability, and it is making plans to tap it large domestic shale and offshore natural gas resources. EIA is reporting shale gas resources on the order of 128 trillion cubic feet (though some estimates are as high as 250 trillion cubic feet). Ukraine's government recently announced deals for exploration and production projects that it hopes could double the country's natural gas production in five to seven years and reduce its dependence on Russian gas. In addition, plans for an LNG terminal on the Black Sea coast are in the works. Ukraine's power sector is quite diverse. It is one of the few countries with capacity diversity scores better than the OECD average (though only marginally). Roughly 70% of it generating capacity is thermal (coal, natural gas, and oil), and most of the remainder is nuclear with a little bit of hydroelectric. Nearly half of it power output is from its fleet of 15 nuclear reactors, and about 35% from coal. To ease its natural gas supply crunch, Ukraine has been switching power stations from natural gas to coal. Accurate electricity price data are lacking.

Ukraine's total energy, transportation, and oil intensities and its carbon dioxide emissions intensity scores are the weakest among the large energy user group. It is obvious the country has a great deal of ground to make up in these areas. Nevertheless, even in these measures the country is making progress absolutely and against the OECD baseline. As an economy in transition, it is not surprising that its energy use and emissions per capita measures are better than the OECD's, and these appear to be changing at about the same rate as the OECD.

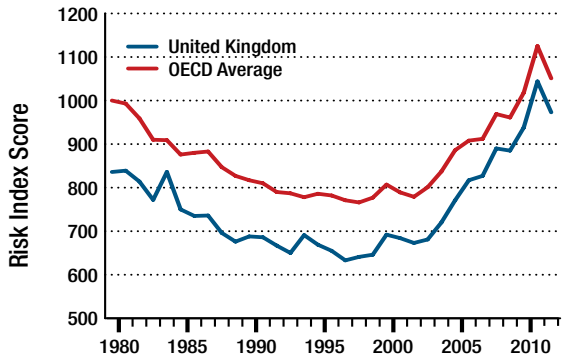


UNITED KINGDOM

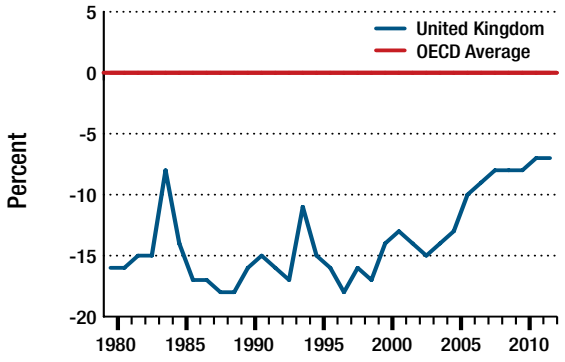
Energy Security Risk Summary: United Kingdom

Risk Scores:	
2012 Energy Security Risk Score	973
2012 Large Energy User Group Rank	4
Score in Previous Year	1,044
Rank in Previous Year	4
Score in 1980	836
Average Score: 1980-2012	755
Best Energy Security Risk Score	633 (1997)
Worst Energy Security Risk Score	1,044 (2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	-14%
Best Relative Score	-18% (1989)
Worst Relative Score	-7% (2011)

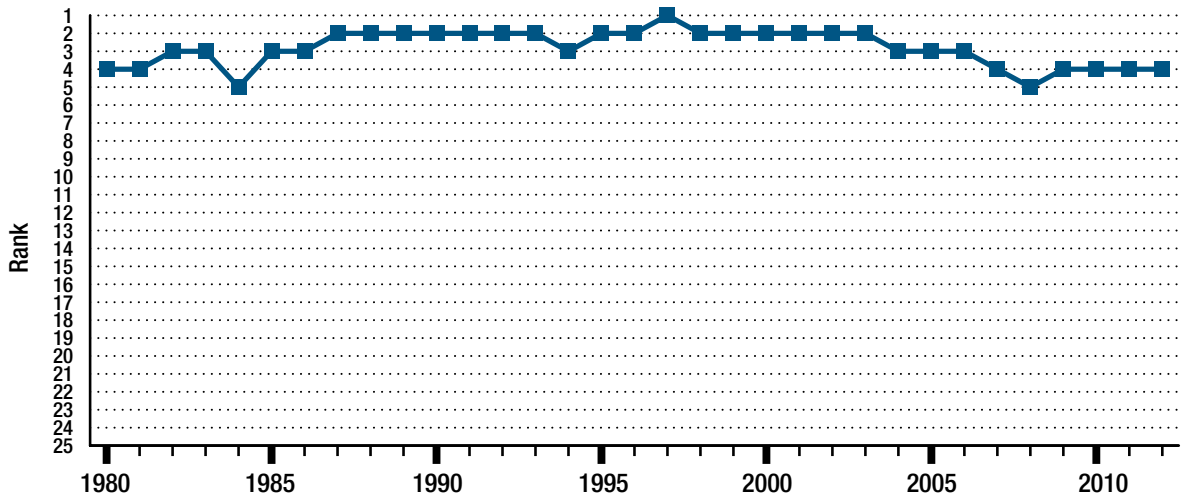
United Kingdom vs. OECD: Risk Index Scores



United Kingdom: Risk Variance from OECD



United Kingdom: Risk Ranking



Since the 1980s, the United Kingdom has scored consistently in the top five most energy secure countries in the large energy user group, and it risk scores have trended well below the OECD average. Since the late 1990s, however, this advantage has been shrinking, from 18% below the OECD average in 1997 to just 7% in 2012. Nevertheless, UK's score of 972 earned it a number four ranking overall. Only Norway, like the UK a large energy producer, had a better score among European countries.

The UK has significant reserves of oil, gas, and coal. It is the second largest producer of crude oil in Europe after Norway and is Europe's third largest producer of natural gas after Norway and the Netherlands. The United Kingdom also was at one time a major coal producer (it is still the second largest in Western Europe after Germany).

Most of the United Kingdom's oil and natural gas reserves are in the North Sea. From 245,000 barrels per day in 1976, oil production peaked at nearly 2.6 million barrels per day in 1999. From 1981 to 2005, the United Kingdom was self-sufficient in petroleum, but beginning in 2006, the United Kingdom became a net importer of oil because of declining North Sea output, which in 2010 was less than half its peak. A net exporter of natural gas from 1997 to 2003, the United Kingdom has since then been importing steadily larger amounts of natural gas.

While the risks to the United Kingdom from both oil and natural gas imports are better than the OECD average, the spread has been shrinking in recent years. Indeed, over the last three years, the UK's oil, natural gas, and coal imports risks have been no better or worse than the OECD baseline. The Looking to the future, the application of new drilling techniques, such as hydraulic fracturing, horizontal drilling, and new deep-water technologies could help the United Kingdom maintain if not increase its domestic production of oil and natural gas.

For example, EIA estimates UK shale formations may also hold as much as 700 million barrels of technically recoverable oil and 26 trillion cubic feet of natural gas, which is nearly three times the estimated current proved figure of 9 trillion cubic feet. Some other shale gas estimates are considerably higher. The British Geological Survey recently provided a central estimate of 1,329 trillion cubic feet of natural gas resources in central Britain. Around 40 exploratory wells could be drilled over the next couple of years to find out if these resources can be extracted economically.

One reason for the country's recent flip to a net importer of natural gas has been the United Kingdom's policy to convert a large portion of the power sector's capacity to natural gas from coal. From virtually none in the mid 1980s, natural gas now produces about 40% of the UK's electric power, while the share for coal has slipped from roughly 70% to 30%. Coal production in 2010 was just 14% the level in 1980, so to meet demand, the United Kingdom imports large quantities of coal and has been doing so since 1984, the year United Kingdom coal miners went out on strike. (United Kingdom coal production from 1983 to 1984 dropped 57%—which shows up as a large upward spike in the United Kingdom's risk index in 1984—and production since has never reached pre-strike levels.)

In addition to natural gas and coal, the United Kingdom has 22 megawatts of nuclear capacity in the power sector, and in 2008 the U.K. government announced it would support additional nuclear power builds. Mandates also require the use of renewables. The United Kingdom is situated such that is has a rich wind resource, and wind accounts for most of the renewable capacity.

A growing concern is the shrinking of capacity margins, especially during the winter months when the electricity system is expected to reach 95% capacity, a situation that has raised could lead to blackouts. Recent closures of large coal and older natural gas plants have added to this concern. These developments have contributed to the country's very high electricity rates, which is another area where the UK is seeing its advantage slip away relative to the OECD baseline. UK power rates are among the highest in the International Index. This may become an even larger concern in the future as more and more affordable baseload capacity is retired and more expensive power generation sources, such as offshore wind, are added to the system.

The United Kingdom is fairly energy efficient economy. Its trends in the intensity and per capita aspects of overall energy use, transportation energy use, petroleum (intensity only) and carbon dioxide emissions have moved largely in line with the OECD average.

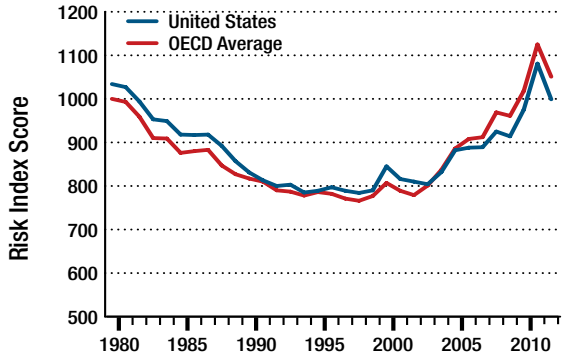
UNITED STATES

Energy Security Risk Summary: United States

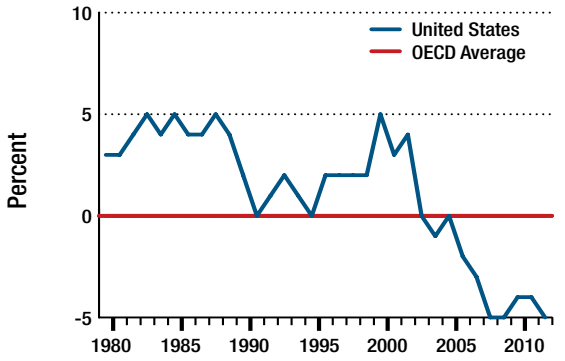
Risk Scores:	
2012 Energy Security Risk Score	999
2012 Large Energy User Group Rank	6
Score in Previous Year	1,081
Rank in Previous Year	7
Score in 1980	1,034
Average Score: 1980-2012	882
Best Energy Security Risk Score	784 (1998)
Worst Energy Security Risk Score	1,081(2011)
Risk Scores Relative to OECD Average:	
Average Annual Difference 1980-2012	1%
Best Relative Score	-5% (2009)
Worst Relative Score	5% (1988)

Note: It should be emphasized that the index data presented here and the index data presented in the Energy Institute's U.S. Index of 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.

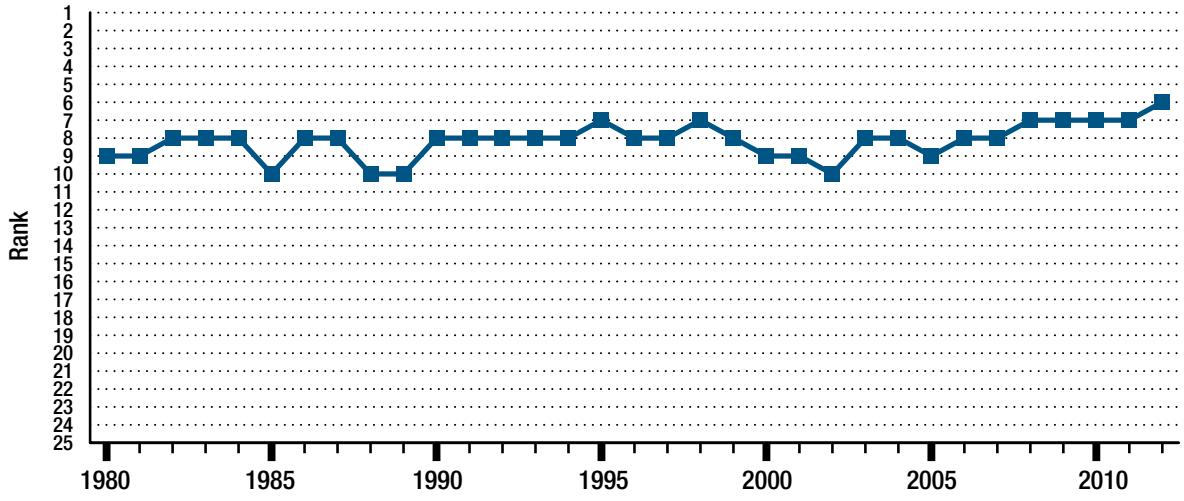
United States vs. OECD: Risk Index Scores



United States: Risk Variance from OECD



United States: Risk Ranking



For most of the 1980 to 2010 period, U.S. energy security risks have run within a range of 5% higher or lower than the OECD average. With a 2012 total risk score of 999, the United States moved up one place in the ranking of the large energy user group to number six, besting Australia by just a single point. Since 2000, the United States has made steady gains against the OECD average; that is, is risks has risen at a slower pace compared to the OECD baseline. The United States is one of nine countries with a 2012 risk score lower than its 1980 score.

The United States is the world's largest economy, third most populous country, and second largest energy consumer. In addition to being a very large energy user, it is also a very large energy producer, with an abundance of energy resources of all kinds. According to the Congressional Research Service, U.S. fossil fuel reserves of 971 billion barrels of oil equivalent are larger than the reserves in any other country—only Russia even comes close—accounting for 17% of the world total. Coal is the dominant fuel, accounting for more than 90% of all U.S. reserves on an oil equivalent basis. The CRS estimates, however, than an additional 396 barrels of oil equivalent of undiscovered cruel oil and natural gas also might be available in the future.

Except for oil, the United States is largely self-reliant in energy. In 2012, it was the world's third largest producer of oil and second largest producer of natural gas and coal. The U.S., therefore, has a significant advantage over many countries in the large energy user group when import risks are considered. Declining domestic oil production and rising imports as a share of demand have been a perennial concern in the U.S. for decades. Yet even given rapidly growing oil imports over the years, this has been a comparative advantage for the United States because the situation in the average OECD country has been even worse.

In addition to the very large drop in risk associated with declining energy price and expenditure volatility—which benefited all countries about equally--the impacts of the unconventional oil and natural gas boom in the United States lowered U.S. energy security risks in 2012 by increasing supply security, reducing net imports, and putting downward pressure on energy costs and expenditures. In 2012, an 835,000 barrel per day increase in production was largely on the strength of increased production of unconventional oil on private and State lands, most notably in the Bakken Shale formation in North Dakota and the Eagle Ford Shale and Permian Basin in Texas. The rise in 2013 may be even larger. Growing domestic production of these fuels led to greater domestic and global supplies than would have existed otherwise, reduced import exposure risks, and lowered import expenditures by 13% in 2012. The United States also is a large producer of refined products and in 2009 became a net exporter of refined petroleum.

Greater unconventional natural gas production—shale gas accounted for more than 30% of U.S. production in 2012—also lowered natural gas risks further. Surging output has caused the link between the price of crude oil and natural gas to be severed in the United States, and the price of natural gas, unlike in the rest of the world, is set entirely based on supply and demand fundamentals. The United States also is well on its way to becoming a net exporter of natural gas rather than a net importer. To date, four LNG export licenses have been issued by the Department of Energy, and more are in the pipeline.

The United States also has proved coal reserves—over 250 years worth at the current rate of consumption. Coal is particularly important as a reliable fuel for base load power generation and contributes to low-cost electricity. The United States also is a net exporter of coal, and exports of coal also are expected to increase. It is important that regulators ensure that port facilities are able to accommodate higher coal exports, which contributes to lowering the global supply risks for this fuel.

These developments have improved U.S. energy security relative to its peers in the large energy user group. U.S. oil, gas, and coal import risks are much lower than the OECD baseline average and improving. Greater domestic production also has lowered the risks, relative to the OECD average, associated with energy import expenditures as a share of the economy.

The U.S. power sector is fairly diverse and is about average for the OECD. Thermal capacity—mostly fired by coal (40%) and natural gas (55%), with very little

oil—accounted for about 75% of total capacity in 2012, with nuclear accounting for 10%, hydroelectric close to 8%, and non-hydro renewables about 5%.

Despite an avalanche of regulations and price pressure, coal was the top electricity producer in 2012, generating 38% of total electricity, followed by natural gas (30%) and nuclear (19%). This situation could change appreciably in the coming years. Pending new environmental regulations could shut down a large portion of base load coal-fired capacity, much of which would have to be replaced by natural gas-fired facilities or nuclear. Moreover, EPA's proposed New Source Performance Standards for greenhouse gas emissions from new power plants would essentially prevent any new coal plants from being built unless equipped with carbon capture and storage technology, a technology not commercially available yet. This could have potentially devastating consequences for U.S. power sector diversity and energy security. Anticipated EPA rules covering existing power plants will compound these concerns.

Nuclear power also faces challenges. Domestically, four new reactors are under construction—two in Georgia and two in South Carolina—with start-up planned for 2015. The outlook for additional new builds, however, is not auspicious, especially in deregulated markets. The recent natural gas glut has pushed prices for that fuel to sustained lows and has clearly impacted utilities' decisions to invest in new reactors. Many Public Utility Commissions are unable or unwilling to shoulder the tremendous front-loaded cost of financing new construction when costs benefits are not realized for years or decades down the road. Uncertainty about nuclear waste policy also hangs over the nuclear industry.

As a result of renewable portfolio standards in many states, renewable capacity is expected to grow rapidly. Wind facilities will benefit from an extension of a production tax credit if construction begins before the end of 2013. This new arrangement, which replaces the usual "placed in service" standard for qualifying facilities, will for all intents a purposes prolong and gradually phase out the credit.

Set against the OECD average, the U.S. also has comparatively lower energy costs, both in terms of energy costs per dollar of GDP and retail electricity rates, and this advantage appears to be growing. We anticipate that future editions of the International Index will show the U.S. increasing its edge in this regard through the continued use of coal and as the fall in natural gas prices begins are further reflected in the U.S. data and as other OECD countries pursue more expensive options.

The United States uses more energy per person than all but two countries—Canada and Norway—in the large energy user group, and its per capita emissions of carbon dioxide also are considerably higher than other countries in the group. These three metrics represent the largest source of risk for the United States compared to the OECD average. All three of these risks, however, have shown rapid improvement relative to the OECD baseline over the last decade.

The United States also uses generally more energy overall and in the transportation sector to produce a dollar of GDP, than the OCD average, but the differences are not all that large. The same goes for carbon dioxide intensity. Since 2000, each of these metrics has been improving at about the same rate as the OECD average. New efficiency standards for appliances and vehicles may accelerate the improvement seen in these areas.

Overall, then, U.S. energy security appears to be improving vis-à-vis the OECD baseline. The largest drivers of this relative improvement have been increased domestic energy production and lower energy costs. Moreover, in those areas where the U.S. is performing relatively worse than the OECD average, the gap is narrowing, implying that the U.S. is improving in these areas at a faster rate than the OECD.

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, International Energy Agency (IEA), the OECD, and others. EIA's database reflects its efforts to compile and curate many disparate sources of information.[13]

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 200 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.

Table A1-3. Metrics Used to Create International Index of Energy Security Risk				
Metric by Classification		**Definition**	**Importance**	**Weight (Percent)**
Global Fuel Metrics				**15**
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				**16**
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				**19**
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				**14**
	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
	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
	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
	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			**15**
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
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
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**
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
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			**8**
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
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**
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
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
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

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.

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.[14]

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.[15]

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	14
Energy Use Intensity	15.3	15
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.

Methodological Revisions in the 2013 Edition

This year's International Index is the second in the series, and it incorporates modifications to the earlier work. These include the addition of a new metric, changes to an existing metric, and various other revisions described below.

- A new metric, GDP per capita, was added to the International Index this year, GDP per capita, raising the total number of metrics to 29. Energy use, while it entails risk, is highly correlated with economic growth. Its use leads to more dynamic, innovative, productive, and wealthy societies whose populations enjoy better health and longer life expectancies. GDP per capita was added as a metric to capture the positive aspects of energy use as driver of economic growth. GDP growth not only increases the capacity of a country to cope with energy shocks, it also provides the wherewithal to make needed investments in energy and other infrastructure. GDP per capita data were normalized, and because a rise in this metric lowers risk, the normalized numbers were "flipped." The range of GDP per capita among countries is quite large. To narrow the range of high and low values, the square root of the inverted normalized values was calculated the come up with a final index value for this metric. As with all of our other metrics, the OECD average was used as a baseline value, with its 1980 score being set at 1,000.

- The definition and measurement of the metric measuring the diversity of the power sector changed in this edition. The original metric measured just the diversity of power sector capacity, adjusted for availability. However, the categories of capacity were not at the desired level of detail, most notably the "thermal" category, which encompasses oil-, natural gas-, and coal-fired generating capacity. As a result, fuel-switching among these sources within the thermal category was not being captured. To address this issue, a generation diversity measure that includes coal, hydro, natural gas, nuclear, oil, and renewable was added using data from the World Bank. The generation diversity metric was calculated the same way as the capacity metric, in this case using the Herfindahl–Hirschman Index to measure generation the diversity of the fuel used to generate electricity. The normalized indexes of the two measures were then averaged to arrive at the new measure of "Electricity Diversity" used in this report.

- The last historical year was extended from 2010 to 2012. Efforts to improve the timeliness of the International Index means that the estimation approach for extending missing or incomplete data took on greater importance. Previously, some of the data extrapolations at the beginning or end of the historical series were based on that country's recent trends. Now, these extrapolations are based on the rates of change for the OECD reference group. This is a more neutral assumption that tends to minimize artificial differences when hard data are incomplete.

- The weighting of some of the metrics were adjusted to make them more attuned to energy security concerns in an international context and the addition of a new metric (weightings must add to 100%). Comments received from Europe and Japan, in particular, strongly suggested that the risks associated with natural gas imports and electricity prices should be given greater weight. To accommodate a one percentage point increase in each of these two metrics, the weighting assigned to global coal production and transportation energy use per capita were reduced by one percentage point each. These changes are reflected in Tables A1-3 and A1-4.

- The metric for crude oil prices was as altered to make it consistent with that used in the U.S. Index. It is based on EIA Monthly Energy Review data for the Landed Costs of Imports into the United States, where the data presented in nominal

dollars was then converted into real dollars. For metrics involving oil prices, this resulted in a slight upward trend over time.

- Improvements were made in the data handling for Germany in the 1980 to 1990 period. Since we define our Reference Group to be an OECD-based measure, and since we also hold the geographic boundaries of this Reference Group constant over time, the OECD definition for the International Index includes pre-unification East Germany as well as West Germany. A "combined Germany" measure was created for the pre-unification years, where metrics were constructed using available East and West Germany data. As East Germany data were often less complete, additional assumptions had to be employed. As a result of these improvements and additional scrutiny of the Germany data, there were some early-year changes in the Germany results, and these in turn had modest effects on the early-year OECD average values.

- There were some changes in certain underlying data series. Each year, there are typically revisions in the EIA, IEA, World Bank, and other data sources. Usually the data revisions only affect the most recent year or two, but sometimes go back further in time.

Appendix 2: International Energy Security Risk Index Scores

Appendix 2 presents for the OECD group and the countries in the large energy user group the normalized index scores for the 29 individual metrics used to define, quantify, and construct the International Index and the overall scores. These are found in Tables A2-1 through A2-26.

In addition, risk scores for the top 75 energy-consuming countries (as of 2010) in the International Index database are provided in Table A2-27. These countries together represent more than 95% of global energy demand. The risk scores are provided for 1980 to 2010 in five-year increments and for 2011 and 2012. It should be noted that data for many of countries, particularly price and expenditures data, are sparse if not lacking entirely. In general, where specific price information was not available, we developed proxy prices that would have a neutral effect on a country's risk index. 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.

These and other data also are available in spreadsheet form at the Energy Institute web site.

Table A2-1. International Energy Security Risk Index Scores: OECD Average									
Metric	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,000	926	815	803	701	708	673	682	649
Gas Import Exposure	1,000	1,282	1,017	915	910	931	817	777	768
Coal Import Exposure	1,000	1,006	987	1,354	1,527	1,637	1,763	1,764	1,895
Total Energy Import Exposure	1,000	866	756	748	769	892	969	1,061	1,110
Fossil Fuel Import Expenditure per GDP	1,000	605	663	623	641	859	943	1,032	1,140
Energy Expenditures									
Energy Expenditure Intensity	1,000	774	801	734	646	799	867	891	922
Energy Expenditures per Capita	1,000	852	1,023	996	1,000	1,327	1,468	1,527	1,586
Retail Electricity Prices	1,000	858	944	964	706	765	870	861	852
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,000	473	390	253	206	811	1,277	963	404
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	1,000	954	886	861	808	780	775	772	769
Energy Use Intensity									
Energy Consumption per Capita	1,000	968	1,027	1,081	1,135	1,142	1,084	1,066	1,046
Energy Intensity	1,000	881	807	802	740	696	652	634	619
Petroleum Intensity	1,000	786	726	718	650	608	540	526	512
Electric Power Sector									
Electricity Diversity	1,000	931	896	895	919	949	932	927	962
Non-Carbon Generation	1,000	885	871	851	879	899	881	879	882
Transportation Sector									
Transport Energy per Capita	1,000	1,005	1,151	1,241	1,334	1,375	1,280	1,300	1,274
Transport Energy Intensity	1,000	914	904	920	870	837	770	774	753
Environmental									
CO2 Emissions Trend	1,000	975	1,045	1,111	1,209	1,262	1,203	1,185	1,163
CO2 per Capita	1,000	937	965	983	1,031	1,038	956	935	913
CO2 GDP Intensity	1,000	852	758	729	672	632	575	557	540
Total Index	**1,000**	**876**	**817**	**786**	**807**	**886**	**1,018**	**1,125**	**1,051**

Table A2-2. International Energy Security Risk Index Scores: Australia

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	378	0	131	244	52	401	399	516	525
Gas Import Exposure	176	5	0	0	0	0	0	0	0
Coal Import Exposure	0	0	0	0	0	0	0	0	0
Total Energy Import Exposure	302	0	0	84	0	236	328	357	368
Fossil Fuel Import Expenditure per GDP	268	0	0	90	0	362	516	578	644
Energy Expenditures									
Energy Expenditure Intensity	575	550	517	501	444	632	637	709	766
Energy Expenditures per Capita	651	666	706	728	749	1,176	1,261	1,422	1,562
Retail Electricity Prices	635	556	661	629	442	641	707	700	693
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	575	976	221	272	562	979	943	1,009	728
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	939	907	855	828	769	732	710	705	699
Energy Use Intensity									
Energy Consumption per Capita	1,048	1,163	1,222	1,254	1,417	1,556	1,479	1,409	1,369
Energy Intensity	923	958	892	860	837	834	745	701	669
Petroleum Intensity	851	797	754	735	643	599	539	544	538
Electric Power Sector									
Electricity Diversity	1,109	1,175	1,150	1,173	1,176	1,179	1,196	1,190	1,223
Non-Carbon Generation	1,245	1,283	1,316	1,316	1,333	1,326	1,323	1,299	1,275
Transportation Sector									
Transport Energy per Capita	1,323	1,603	1,667	1,696	1,840	1,955	1,504	1,520	1,474
Transport Energy Intensity	1,165	1,319	1,217	1,163	1,087	1,047	757	756	720
Environmental									
CO2 Emissions Trend	1,000	1,195	1,346	1,454	1,792	2,075	2,131	1,973	1,937
CO2 per Capita	1,223	1,363	1,417	1,446	1,681	1,828	1,735	1,588	1,534
CO2 GDP Intensity	1,077	1,122	1,035	992	993	980	874	790	750
Total Index	**828**	**797**	**722**	**703**	**743**	**862**	**953**	**1,070**	**1,000**

Table A2-3. International Energy Security Risk Index Scores: Brazil

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,321	555	597	537	301	77	0	41	101
Gas Import Exposure	6	6	4	3	600	1,098	1,005	844	976
Coal Import Exposure	4,769	4,963	5,203	5,969	5,324	5,307	5,675	5,647	5,516
Total Energy Import Exposure	1,400	453	548	539	392	240	219	240	257
Fossil Fuel Import Expenditure per GDP	2,966	803	913	563	729	240	46	46	47
Energy Expenditures									
Energy Expenditure Intensity	1,589	1,264	980	592	1,069	1,347	1,508	1,788	2,133
Energy Expenditures per Capita	367	276	215	139	258	350	464	561	669
Retail Electricity Prices	1,028	1,148	1,134	792	888	906	999	988	978
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,589	858	984	1,491	1,305	1,850	2,981	3,513	3,382
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	2,077	2,139	2,133	2,057	2,032	1,959	1,799	1,783	1,783
Energy Use Intensity									
Energy Consumption per Capita	186	189	216	244	275	282	325	332	325
Energy Intensity	800	866	982	1,030	1,134	1,083	1,052	1,057	1,034
Petroleum Intensity	972	865	1,065	1,116	1,224	1,086	1,039	1,077	1,121
Electric Power Sector									
Electricity Diversity	1,021	1,041	1,089	1,117	1,002	869	793	779	762
Non-Carbon Generation	84	62	63	69	121	143	173	156	140
Transportation Sector									
Transport Energy per Capita	221	204	283	354	393	397	496	503	491
Transport Energy Intensity	955	931	1,289	1,497	1,623	1,522	1,606	1,598	1,562
Environmental									
CO2 Emissions Trend	1,000	1,038	1,278	1,557	1,855	1,997	2,429	2,561	2,514
CO2 per Capita	138	128	143	161	178	180	209	218	212
CO2 GDP Intensity	595	585	652	683	736	691	676	694	675
Total Index	**1,127**	**898**	**896**	**865**	**948**	**963**	**1,133**	**1,280**	**1,231**

Table A2-4. International Energy Security Risk Index Scores: Canada

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	51	0	0	0	0	0	0	0	0
Gas Import Exposure	0	0	0	0	0	0	0	0	0
Coal Import Exposure	212	0	0	0	0	0	0	0	0
Total Energy Import Exposure	38	0	0	0	0	0	0	0	0
Fossil Fuel Import Expenditure per GDP	43	0	0	0	0	0	0	0	0
Energy Expenditures									
Energy Expenditure Intensity	697	622	567	428	385	632	682	758	845
Energy Expenditures per Capita	882	855	839	652	686	1,216	1,318	1,488	1,667
Retail Electricity Prices	416	415	490	452	370	468	526	521	515
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	697	268	195	484	426	1,020	1,942	1,606	1,037
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	887	852	821	809	748	720	718	713	711
Energy Use Intensity									
Energy Consumption per Capita	2,237	2,198	2,219	2,337	2,428	2,463	2,139	2,198	2,145
Energy Intensity	1,761	1,594	1,496	1,528	1,359	1,277	1,103	1,117	1,084
Petroleum Intensity	1,432	1,011	998	957	875	887	815	806	805
Electric Power Sector									
Electricity Diversity	656	604	583	572	623	602	601	600	599
Non-Carbon Generation	317	289	317	304	387	360	342	315	290
Transportation Sector									
Transport Energy per Capita	2,552	2,183	2,206	2,276	2,382	2,405	2,314	2,341	2,282
Transport Energy Intensity	2,009	1,583	1,487	1,488	1,333	1,247	1,193	1,190	1,153
Environmental									
CO2 Emissions Trend	1,000	970	1,029	1,112	1,253	1,364	1,195	1,208	1,186
CO2 per Capita	1,681	1,546	1,530	1,566	1,684	1,745	1,448	1,448	1,406
CO2 GDP Intensity	1,323	1,121	1,032	1,024	942	904	746	736	710
Total Index	**964**	**837**	**776**	**753**	**778**	**846**	**960**	**1,070**	**987**

Table A2-5. International Energy Security Risk Index Scores: China

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	0	0	0	109	305	432	546	545	555
Gas Import Exposure	6	6	0	0	0	0	233	435	564
Coal Import Exposure	0	0	0	0	0	0	0	0	169
Total Energy Import Exposure	0	0	0	42	156	183	374	371	388
Fossil Fuel Import Expenditure per GDP	0	0	0	75	374	544	1,092	1,143	1,217
Energy Expenditures									
Energy Expenditure Intensity	3,353	2,059	1,300	698	717	811	1,100	1,109	1,188
Energy Expenditures per Capita	41	39	33	30	44	77	173	190	218
Retail Electricity Prices	280	313	258	238	312	318	350	347	343
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	3,353	3,405	1,001	1,349	569	916	914	511	606
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	9,084	7,288	6,267	4,835	4,026	3,242	2,518	2,414	2,331
Energy Use Intensity									
Energy Consumption per Capita	99	112	129	155	182	293	424	458	450
Energy Intensity	8,164	5,962	5,053	3,624	2,951	3,074	2,685	2,669	2,445
Petroleum Intensity	3,545	2,275	1,898	1,559	1,470	1,289	1,056	924	896
Electric Power Sector									
Electricity Diversity	1,027	1,034	1,096	1,089	1,071	1,090	1,055	1,008	965
Non-Carbon Generation	1,165	1,118	1,150	1,154	1,187	1,184	1,145	1,208	1,274
Transportation Sector									
Transport Energy per Capita	11	14	20	31	49	82	170	173	169
Transport Energy Intensity	917	727	773	722	791	864	1,076	1,007	921
Environmental									
CO2 Emissions Trend	1,000	1,219	1,503	1,880	2,259	3,772	5,521	6,017	5,907
CO2 per Capita	133	152	173	204	234	379	540	586	572
CO2 GDP Intensity	11,008	8,063	6,810	4,775	3,796	3,980	3,425	3,415	3,110
Total Index	**1,966**	**1,562**	**1,255**	**1,022**	**974**	**1,044**	**1,197**	**1,302**	**1,228**

Table A2-6. International Energy Security Risk Index Scores: Denmark

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,648	1,290	501	193	0	0	0	0	0
Gas Import Exposure	1,647	0	0	0	0	0	0	0	0
Coal Import Exposure	10,529	9,131	7,421	8,248	7,728	7,480	7,384	7,222	7,164
Total Energy Import Exposure	2,732	2,170	981	841	340	447	452	539	580
Fossil Fuel Import Expenditure per GDP	1,666	620	472	323	150	180	172	181	193
Energy Expenditures									
Energy Expenditure Intensity	691	335	515	542	448	530	581	561	580
Energy Expenditures per Capita	1,128	626	1,028	1,193	1,113	1,382	1,477	1,435	1,472
Retail Electricity Prices	1,489	968	1,516	1,652	1,380	1,822	1,984	1,963	1,943
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	691	646	692	334	450	431	853	744	451
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	782	730	706	673	633	619	626	624	627
Energy Use Intensity									
Energy Consumption per Capita	946	894	840	948	922	877	841	789	776
Energy Intensity	578	477	419	429	370	335	330	307	305
Petroleum Intensity	826	563	445	461	377	309	283	268	266
Electric Power Sector									
Electricity Diversity	1,556	1,551	1,513	1,473	1,327	1,216	1,150	1,129	1,107
Non-Carbon Generation	1,458	1,455	1,408	1,370	1,198	1,013	944	824	720
Transportation Sector									
Transport Energy per Capita	729	826	936	1,068	1,150	1,185	1,226	1,248	1,226
Transport Energy Intensity	445	441	467	483	461	453	481	486	482
Environmental									
CO2 Emissions Trend	1,000	975	879	1,065	839	798	706	718	705
CO2 per Capita	1,146	1,120	1,004	1,195	922	865	747	757	741
CO2 GDP Intensity	700	597	501	541	370	331	293	295	291
Total Index	**1,298**	**1,023**	**900**	**879**	**827**	**866**	**999**	**1,099**	**1,024**

Table A2-7. International Energy Security Risk Index Scores: France

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,617	1,631	1,274	1,135	982	960	983	1,017	1,011
Gas Import Exposure	4,262	5,003	3,704	2,676	2,502	2,255	1,975	1,989	1,950
Coal Import Exposure	6,232	5,108	4,317	5,265	6,532	7,480	7,384	7,222	7,164
Total Energy Import Exposure	2,039	1,701	1,233	1,022	1,068	1,170	1,241	1,374	1,436
Fossil Fuel Import Expenditure per GDP	2,016	954	1,030	884	733	949	1,030	1,132	1,275
Energy Expenditures									
Energy Expenditure Intensity	906	439	472	418	318	414	434	462	496
Energy Expenditures per Capita	1,155	586	719	664	565	767	806	871	930
Retail Electricity Prices	1,673	977	1,384	1,319	711	876	873	864	855
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	906	536	755	461	227	493	946	735	429
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	885	864	809	792	749	733	733	727	729
Energy Use Intensity									
Energy Consumption per Capita	853	825	877	948	1,010	1,009	952	926	910
Energy Intensity	668	615	574	595	567	543	511	490	483
Petroleum Intensity	764	550	489	483	440	405	361	346	336
Electric Power Sector									
Electricity Diversity	602	583	664	671	681	678	642	629	663
Non-Carbon Generation	687	235	163	112	133	156	143	124	108
Transportation Sector									
Transport Energy per Capita	774	750	895	983	1,064	987	862	876	860
Transport Energy Intensity	605	559	585	617	597	531	463	463	457
Environmental									
CO2 Emissions Trend	1,000	812	752	762	822	847	795	766	752
CO2 per Capita	800	631	569	565	596	592	540	517	506
CO2 GDP Intensity	626	471	372	355	335	319	290	274	269
Total Index	**1,250**	**1,026**	**934**	**860**	**860**	**928**	**1,041**	**1,152**	**1,088**

Table A2-8. International Energy Security Risk Index Scores: Germany

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,679	1,736	1,357	1,151	980	943	974	1,000	990
Gas Import Exposure	3,860	3,887	3,018	2,277	1,967	1,842	1,716	1,706	1,688
Coal Import Exposure	42	0	269	632	1,246	1,202	1,580	1,366	1,438
Total Energy Import Exposure	1,578	1,429	1,191	1,238	1,210	1,368	1,569	1,825	1,915
Fossil Fuel Import Expenditure per GDP	1,681	836	886	1,040	677	983	948	1,040	1,173
Energy Expenditures									
Energy Expenditure Intensity	1,342	756	830	579	328	472	442	460	504
Energy Expenditures per Capita	1,654	1,005	1,269	951	587	868	877	940	1,034
Retail Electricity Prices	1,503	1,289	1,419	1,607	843	1,314	1,808	1,789	1,771
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,342	987	831	361	246	620	901	563	265
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	899	866	807	779	746	736	709	699	697
Energy Use Intensity									
Energy Consumption per Capita	1,066	1,072	1,050	989	984	982	957	898	886
Energy Intensity	862	804	685	600	548	533	481	438	430
Petroleum Intensity	761	611	526	511	448	412	363	342	331
Electric Power Sector									
Electricity Diversity	1,129	1,020	1,559	916	878	807	681	658	679
Non-Carbon Generation	1,219	1,018	1,001	952	918	913	860	880	901
Transportation Sector									
Transport Energy per Capita	744	770	949	998	1,032	941	839	857	844
Transport Energy Intensity	602	578	619	605	575	510	422	418	410
Environmental									
CO2 Emissions Trend	1,000	960	938	844	809	802	751	709	696
CO2 per Capita	1,219	1,180	1,127	986	939	929	877	827	811
CO2 GDP Intensity	986	885	735	598	523	504	441	404	394
Total Index	**1,195**	**1,025**	**965**	**847**	**783**	**863**	**1,003**	**1,106**	**1,047**

Table A2-9. International Energy Security Risk Index Scores: India

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,195	522	565	615	656	674	722	756	755
Gas Import Exposure	6	6	4	3	3	390	380	517	352
Coal Import Exposure	0	184	0	209	502	460	559	811	1,388
Total Energy Import Exposure	683	269	324	388	489	637	853	858	901
Fossil Fuel Import Expenditure per GDP	1,493	561	595	385	684	1,087	1,077	1,153	1,276
Energy Expenditures									
Energy Expenditure Intensity	1,044	940	763	442	670	910	814	884	953
Energy Expenditures per Capita	17	17	17	11	21	37	46	53	58
Retail Electricity Prices	284	317	261	208	231	288	318	315	311
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,044	756	984	779	880	1,377	1,073	1,202	803
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	7,895	7,363	6,718	6,225	5,615	4,958	4,194	4,093	4,054
Energy Use Intensity									
Energy Consumption per Capita	32	42	51	67	72	81	102	109	106
Energy Intensity	2,024	2,303	2,298	2,605	2,265	2,000	1,796	1,819	1,740
Petroleum Intensity	1,370	1,482	1,449	1,525	1,537	1,308	1,134	1,123	1,092
Electric Power Sector									
Electricity Diversity	892	964	1,054	1,092	1,066	1,029	1,052	1,037	1,022
Non-Carbon Generation	853	999	1,054	1,169	1,209	1,184	1,210	1,177	1,145
Transportation Sector									
Transport Energy per Capita	10	15	22	35	28	29	46	47	46
Transport Energy Intensity	616	824	982	1,374	883	708	817	786	750
Environmental									
CO2 Emissions Trend	1,000	1,536	1,987	2,988	3,403	4,057	5,498	5,926	5,818
CO2 per Capita	38	52	60	82	86	95	120	128	124
CO2 GDP Intensity	2,347	2,804	2,716	3,188	2,709	2,328	2,111	2,140	2,035
Total Index	**1,173**	**1,087**	**1,031**	**1,030**	**1,043**	**1,078**	**1,171**	**1,311**	**1,237**

Table A2-10. International Energy Security Risk Index Scores: Indonesia

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	0	0	0	0	0	102	256	98	156
Gas Import Exposure	0	0	0	0	0	0	0	0	0
Coal Import Exposure	289	0	0	0	0	0	0	0	0
Total Energy Import Exposure	0	0	0	0	0	234	250	254	262
Fossil Fuel Import Expenditure per GDP	0	0	0	0	0	268	535	577	626
Energy Expenditures									
Energy Expenditure Intensity	625	784	449	409	165	626	1,061	936	992
Energy Expenditures per Capita	19	28	21	25	10	44	91	85	94
Retail Electricity Prices	638	712	615	552	172	359	299	296	293
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	625	973	290	613	979	1,233	2,426	2,369	1,931
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	5,720	5,271	4,653	4,014	4,093	3,779	3,404	3,320	3,241
Energy Use Intensity									
Energy Consumption per Capita	45	53	73	94	104	116	141	144	141
Energy Intensity	1,472	1,474	1,571	1,511	1,744	1,661	1,637	1,589	1,477
Petroleum Intensity	2,191	1,899	1,885	1,600	1,985	1,944	1,592	1,208	1,137
Electric Power Sector									
Electricity Diversity	1,111	1,244	1,111	1,160	1,172	1,223	1,252	1,257	1,261
Non-Carbon Generation	1,205	1,228	1,196	1,194	1,216	1,251	1,215	1,245	1,275
Transportation Sector									
Transport Energy per Capita	27	32	42	62	79	87	111	112	109
Transport Energy Intensity	874	889	916	1,006	1,331	1,242	1,288	1,237	1,148
Environmental									
CO2 Emissions Trend	1,000	1,181	1,818	2,504	3,103	3,855	4,832	4,974	4,884
CO2 per Capita	53	56	79	100	115	133	156	158	153
CO2 GDP Intensity	1,744	1,566	1,708	1,611	1,929	1,902	1,803	1,743	1,611
Total Index	**945**	**916**	**813**	**773**	**861**	**942**	**1,132**	**1,218**	**1,127**

Table A2-11. International Energy Security Risk Index Scores: Italy

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,620	1,650	1,277	1,125	955	909	922	951	931
Gas Import Exposure	3,250	3,446	2,618	1,860	2,009	1,986	1,803	1,797	1,752
Coal Import Exposure	9,750	8,416	7,085	8,169	7,722	7,452	7,349	7,193	7,136
Total Energy Import Exposure	2,257	2,176	1,686	1,508	1,564	1,715	1,880	2,124	2,230
Fossil Fuel Import Expenditure per GDP	1,425	853	1,246	941	1,186	1,233	1,353	1,484	1,682
Energy Expenditures									
Energy Expenditure Intensity	634	393	622	479	577	608	618	628	644
Energy Expenditures per Capita	704	474	872	714	945	1,016	988	1,004	1,001
Retail Electricity Prices	1,128	991	1,444	1,341	947	1,222	1,465	1,450	1,435
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	634	390	740	597	479	1,376	1,086	718	184
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	947	910	843	817	780	773	790	790	801
Energy Use Intensity									
Energy Consumption per Capita	609	598	666	696	748	774	708	685	674
Energy Intensity	546	495	473	465	455	462	442	427	432
Petroleum Intensity	734	595	559	545	473	433	380	357	329
Electric Power Sector									
Electricity Diversity	904	905	944	993	1,032	1,051	1,038	1,010	1,073
Non-Carbon Generation	1,044	1,045	1,217	1,200	1,180	1,212	1,060	1,023	987
Transportation Sector									
Transport Energy per Capita	651	727	883	955	1,010	1,026	897	913	897
Transport Energy Intensity	584	601	628	638	615	612	559	569	575
Environmental									
CO2 Emissions Trend	1,000	984	1,117	1,160	1,204	1,269	1,121	1,078	1,059
CO2 per Capita	595	584	662	686	711	728	623	597	584
CO2 GDP Intensity	534	483	471	458	433	434	388	372	374
Total Index	**1,196**	**1,072**	**1,035**	**960**	**990**	**1,070**	**1,171**	**1,277**	**1,208**

Table A2-12. International Energy Security Risk Index Scores: Japan

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,666	1,716	1,340	1,184	1,009	978	993	1,030	1,025
Gas Import Exposure	5,450	5,789	3,692	2,699	2,441	2,181	1,917	1,934	1,898
Coal Import Exposure	8,100	7,650	6,757	7,839	7,578	7,480	7,384	7,222	7,164
Total Energy Import Exposure	2,384	2,290	1,825	1,689	1,578	1,743	2,006	2,291	2,412
Fossil Fuel Import Expenditure per GDP	1,824	998	885	995	933	923	1,015	1,141	1,256
Energy Expenditures									
Energy Expenditure Intensity	767	420	379	423	394	395	434	492	559
Energy Expenditures per Capita	881	575	647	763	734	774	868	975	1,131
Retail Electricity Prices	1,720	1,420	1,630	2,134	1,496	1,168	1,293	1,279	1,266
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	767	689	180	114	309	284	1,127	887	651
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	932	853	764	743	732	713	706	709	702
Energy Use Intensity									
Energy Consumption per Capita	731	730	853	938	992	1,017	959	915	905
Energy Intensity	634	531	498	518	532	517	478	460	446
Petroleum Intensity	880	639	600	599	556	506	417	421	436
Electric Power Sector									
Electricity Diversity	893	827	810	779	808	801	810	811	911
Non-Carbon Generation	1,019	904	940	886	861	906	922	1,085	1,276
Transportation Sector									
Transport Energy per Capita	576	580	774	895	936	920	836	852	842
Transport Energy Intensity	500	422	452	494	502	468	417	429	415
Environmental									
CO2 Emissions Trend	1,000	978	1,106	1,179	1,269	1,311	1,246	1,247	1,224
CO2 per Capita	733	693	766	804	856	878	837	835	821
CO2 GDP Intensity	636	504	447	444	458	446	417	420	404
Total Index	**1,320**	**1,173**	**1,009**	**1,008**	**998**	**991**	**1,141**	**1,267**	**1,219**

Table A2-13. International Energy Security Risk Index Scores: Mexico

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	0	0	0	0	0	0	0	0	0
Gas Import Exposure	0	0	71	247	160	431	429	516	168
Coal Import Exposure	2,124	662	41	1,283	1,361	3,178	3,221	2,658	2,752
Total Energy Import Exposure	15	13	13	32	54	177	231	245	261
Fossil Fuel Import Expenditure per GDP	2	2	2	4	11	76	69	68	66
Energy Expenditures									
Energy Expenditure Intensity	159	233	270	245	440	528	558	607	630
Energy Expenditures per Capita	57	83	95	84	180	222	239	267	285
Retail Electricity Prices	768	344	422	355	477	601	495	489	484
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	159	352	492	524	483	353	775	798	532
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	1,667	1,672	1,686	1,709	1,562	1,540	1,524	1,504	1,485
Energy Use Intensity									
Energy Consumption per Capita	297	318	304	310	342	341	347	367	358
Energy Intensity	825	887	864	905	835	810	806	831	790
Petroleum Intensity	1,198	1,265	1,261	1,317	1,175	1,083	979	966	935
Electric Power Sector									
Electricity Diversity	949	1,044	976	969	1,006	1,085	1,122	1,131	1,140
Non-Carbon Generation	1,056	1,027	1,070	1,028	1,097	1,156	1,159	1,155	1,150
Transportation Sector									
Transport Energy per Capita	294	301	431	439	509	541	632	638	621
Transport Energy Intensity	817	842	1,226	1,283	1,241	1,284	1,467	1,444	1,370
Environmental									
CO2 Emissions Trend	1,000	1,168	1,257	1,337	1,593	1,655	1,798	1,924	1,888
CO2 per Capita	309	326	317	304	333	325	331	350	339
CO2 GDP Intensity	858	910	902	889	812	770	769	792	748
Total Index	**709**	**653**	**623**	**628**	**681**	**763**	**902**	**1,015**	**928**

Table A2-14. International Energy Security Risk Index Scores: Netherlands

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,614	1,449	1,158	1,091	943	956	991	1,019	997
Gas Import Exposure	0	0	0	0	0	0	0	0	0
Coal Import Exposure	10,529	9,131	7,421	8,248	7,728	7,480	7,384	7,222	7,164
Total Energy Import Exposure	1,544	1,141	977	843	904	962	1,318	1,468	1,527
Fossil Fuel Import Expenditure per GDP	1,842	859	1,096	1,123	974	1,423	1,565	1,778	2,066
Energy Expenditures									
Energy Expenditure Intensity	1,097	673	784	858	648	1,175	998	1,029	1,119
Energy Expenditures per Capita	1,492	945	1,258	1,492	1,332	2,518	2,252	2,333	2,502
Retail Electricity Prices	1,679	984	1,080	1,069	916	1,460	1,231	1,218	1,206
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,097	804	1,174	479	431	1,993	1,652	1,325	535
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	856	843	788	757	696	682	665	663	668
Energy Use Intensity									
Energy Consumption per Capita	1,272	1,166	1,244	1,298	1,338	1,457	1,442	1,372	1,349
Energy Intensity	932	828	773	745	648	677	637	603	602
Petroleum Intensity	980	714	728	680	621	695	648	635	634
Electric Power Sector									
Electricity Diversity	1,471	1,468	1,451	1,443	1,442	1,367	1,347	1,343	1,339
Non-Carbon Generation	1,345	1,360	1,361	1,348	1,323	1,264	1,244	1,214	1,185
Transportation Sector									
Transport Energy per Capita	849	821	1,001	1,087	1,191	1,287	1,372	1,396	1,370
Transport Energy Intensity	622	583	622	623	577	598	607	614	611
Environmental									
CO2 Emissions Trend	1,000	951	1,050	1,107	1,225	1,335	1,267	1,258	1,235
CO2 per Capita	1,284	1,192	1,276	1,301	1,397	1,487	1,386	1,370	1,339
CO2 GDP Intensity	941	846	793	746	677	691	613	602	597
Total Index	**1,321**	**1,079**	**1,033**	**996**	**988**	**1,191**	**1,273**	**1,384**	**1,312**

Table A2-15. International Energy Security Risk Index Scores: New Zealand

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,513	1,232	612	742	663	820	617	689	720
Gas Import Exposure	0	41	4	4	0	0	0	0	91
Coal Import Exposure	0	0	0	0	0	0	0	0	0
Total Energy Import Exposure	989	563	326	426	435	594	486	505	520
Fossil Fuel Import Expenditure per GDP	1,085	527	386	431	343	625	577	656	734
Energy Expenditures									
Energy Expenditure Intensity	527	371	460	416	302	459	542	572	636
Energy Expenditures per Capita	541	418	528	504	402	688	804	851	968
Retail Electricity Prices	491	269	504	618	420	841	1,011	1,000	990
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	527	455	859	378	486	751	1,490	1,175	782
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	985	941	932	907	865	815	820	819	809
Energy Use Intensity									
Energy Consumption per Capita	898	995	1,191	1,187	1,203	1,148	1,102	1,102	1,081
Energy Intensity	871	880	1,033	977	900	763	741	739	708
Petroleum Intensity	677	534	666	669	620	587	560	540	536
Electric Power Sector									
Electricity Diversity	787	768	763	775	746	733	692	684	677
Non-Carbon Generation	135	333	288	239	399	503	373	337	303
Transportation Sector									
Transport Energy per Capita	1,258	1,247	1,537	1,648	1,686	1,913	1,535	1,556	1,524
Transport Energy Intensity	1,221	1,103	1,334	1,356	1,262	1,272	1,031	1,043	999
Environmental									
CO2 Emissions Trend	1,000	1,151	1,435	1,533	1,788	2,015	1,848	1,855	1,821
CO2 per Capita	582	642	781	756	840	883	766	763	744
CO2 GDP Intensity	564	568	677	622	628	587	515	511	487
Total Index	**835**	**728**	**729**	**694**	**712**	**806**	**916**	**1,025**	**955**

Table A2-16. International Energy Security Risk Index Scores: Norway

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	0	0	0	0	0	0	0	0	0
Gas Import Exposure	0	0	0	0	0	0	0	0	0
Coal Import Exposure	8,440	6,381	5,659	6,659	4,660	0	0	0	0
Total Energy Import Exposure	55	54	29	36	21	0	0	0	0
Fossil Fuel Import Expenditure per GDP	31	16	5	4	2	0	0	0	0
Energy Expenditures									
Energy Expenditure Intensity	482	270	391	403	318	426	462	579	636
Energy Expenditures per Capita	956	620	957	1,155	1,059	1,535	1,635	2,049	2,289
Retail Electricity Prices	520	428	676	621	404	755	979	969	959
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	482	305	486	375	230	477	508	811	793
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	709	659	638	590	547	526	531	531	526
Energy Use Intensity									
Energy Consumption per Capita	1,843	2,093	2,265	2,302	2,487	2,433	2,146	2,118	2,063
Energy Intensity	927	908	922	802	745	673	604	597	572
Petroleum Intensity	588	491	456	397	337	310	304	347	338
Electric Power Sector									
Electricity Diversity	1,452	1,466	1,406	1,456	1,364	1,370	1,309	1,303	1,421
Non-Carbon Generation	2	5	3	4	3	5	56	46	38
Transportation Sector									
Transport Energy per Capita	1,191	1,485	1,760	1,826	1,794	1,847	1,303	1,315	1,279
Transport Energy Intensity	599	644	716	636	537	511	367	371	354
Environmental									
CO2 Emissions Trend	1,000	1,010	1,036	1,128	1,229	1,253	1,344	1,366	1,341
CO2 per Capita	743	738	741	785	830	822	834	837	811
CO2 GDP Intensity	373	320	302	273	249	227	235	236	225
Total Index	**910**	**821**	**808**	**790**	**759**	**725**	**820**	**962**	**909**

Table A2-17. International Energy Security Risk Index Scores: Poland

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,644	1,704	1,335	1,172	973	919	974	1,010	1,001
Gas Import Exposure	2,584	2,834	2,723	1,695	1,602	1,448	1,296	1,283	1,286
Coal Import Exposure	0	0	0	0	0	0	72	8	0
Total Energy Import Exposure	553	526	545	490	604	745	838	890	924
Fossil Fuel Import Expenditure per GDP	636	384	422	730	831	1,144	1,367	1,477	1,643
Energy Expenditures									
Energy Expenditure Intensity	453	350	362	720	579	758	890	944	950
Energy Expenditures per Capita	140	143	94	205	216	331	489	537	550
Retail Electricity Prices	332	153	95	490	458	748	997	987	977
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	374	177	146	530	507	696	2,099	1,574	586
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	1,889	1,923	1,962	1,871	1,637	1,511	1,347	1,324	1,312
Energy Use Intensity									
Energy Consumption per Capita	800	742	582	539	529	541	596	597	589
Energy Intensity	2,776	2,445	2,240	1,885	1,418	1,235	1,083	1,046	1,013
Petroleum Intensity	931	732	675	689	684	672	636	629	574
Electric Power Sector									
Electricity Diversity	1,457	1,427	1,422	1,424	1,420	1,414	1,383	1,369	1,421
Non-Carbon Generation	1,429	1,441	1,449	1,443	1,439	1,425	1,353	1,339	1,325
Transportation Sector									
Transport Energy per Capita	246	230	211	245	331	418	634	642	632
Transport Energy Intensity	900	823	814	859	888	954	1,150	1,125	1,088
Environmental									
CO2 Emissions Trend	1,000	984	778	718	682	670	710	718	705
CO2 per Capita	1,090	1,025	792	722	688	681	721	722	709
CO2 GDP Intensity	4,018	3,425	3,046	2,525	1,842	1,556	1,309	1,266	1,220
Total Index	**1,115**	**1,009**	**905**	**869**	**850**	**900**	**1,100**	**1,196**	**1,101**

Table A2-18. International Energy Security Risk Index Scores: Russian Federation

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	NA	NA	NA	1,462	1,280	872	881	932	955
Global Oil Production	NA	NA	NA	741	689	726	773	810	821
Global Gas Reserves	NA	NA	NA	879	998	983	932	934	971
Global Gas Production	NA	NA	NA	671	730	784	798	863	858
Global Coal Reserves	NA	NA	NA	554	582	675	686	695	695
Global Coal Production	NA	NA	NA	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	NA	NA	NA	0	0	0	0	0	0
Gas Import Exposure	NA	NA	NA	0	0	0	0	0	0
Coal Import Exposure	NA	NA	NA	0	0	0	0	0	0
Total Energy Import Exposure	NA	NA	NA	0	0	0	0	0	0
Fossil Fuel Import Expenditure per GDP	NA	NA	NA	0	0	0	0	0	0
Energy Expenditures									
Energy Expenditure Intensity	NA	NA	NA	339	588	837	1,055	1,085	1,139
Energy Expenditures per Capita	NA	NA	NA	66	125	245	369	394	427
Retail Electricity Prices	NA	NA	NA	964	706	765	870	861	852
Crude Oil Prices	NA	NA	NA	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	NA	NA	NA	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	NA	NA	NA	475	2,050	3,491	2,307	1,584	908
World Oil Refinery Usage	NA	NA	NA	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	NA	NA	NA	2,268	2,166	1,846	1,688	1,656	1,631
Energy Use Intensity									
Energy Consumption per Capita	NA	NA	NA	1,059	1,003	1,095	1,156	1,287	1,266
Energy Intensity	NA	NA	NA	5,451	4,706	3,734	3,294	3,530	3,369
Petroleum Intensity	NA	NA	NA	2,469	1,974	1,584	1,430	1,248	1,207
Electric Power Sector									
Electricity Diversity	NA	NA	NA	912	902	903	910	910	916
Non-Carbon Generation	NA	NA	NA	978	956	952	971	980	989
Transportation Sector									
Transport Energy per Capita	NA	NA	NA	341	350	407	555	565	554
Transport Energy Intensity	NA	NA	NA	1,754	1,643	1,388	1,580	1,548	1,476
Environmental									
CO2 Emissions Trend	NA	NA	NA	919	859	910	941	1,025	1,006
CO2 per Capita	NA	NA	NA	978	926	1,002	1,042	1,130	1,105
CO2 GDP Intensity	NA	NA	NA	5,032	4,343	3,416	2,969	3,100	2,942
Total Index	**NA**	**NA**	**NA**	**1,137**	**1,143**	**1,124**	**1,175**	**1,281**	**1,176**

Table A2-19. International Energy Security Risk Index Scores: South Africa

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,679	1,438	1,077	612	577	600	689	747	747
Gas Import Exposure	4	4	4	3	3	2	1,521	1,452	1,414
Coal Import Exposure	0	0	0	0	0	0	0	0	0
Total Energy Import Exposure	686	543	403	271	229	273	352	361	373
Fossil Fuel Import Expenditure per GDP	3,153	1,214	883	612	544	831	1,193	1,320	1,479
Energy Expenditures									
Energy Expenditure Intensity	1,407	561	537	525	474	661	809	968	1,085
Energy Expenditures per Capita	411	155	143	131	121	190	257	314	357
Retail Electricity Prices	806	379	517	396	279	377	367	363	359
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,407	1,259	719	407	364	1,242	1,779	1,855	1,615
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	1,846	1,902	1,936	1,997	1,977	1,864	1,772	1,752	1,741
Energy Use Intensity									
Energy Consumption per Capita	556	631	562	590	585	609	628	642	626
Energy Intensity	1,894	2,282	2,106	2,353	2,287	2,117	1,973	1,971	1,897
Petroleum Intensity	921	966	953	1,025	972	944	824	884	876
Electric Power Sector									
Electricity Diversity	1,507	1,223	1,290	1,313	1,356	1,333	1,343	1,347	1,404
Non-Carbon Generation	1,444	1,395	1,371	1,362	1,355	1,379	1,373	1,328	1,285
Transportation Sector									
Transport Energy per Capita	356	354	371	391	378	408	409	413	402
Transport Energy Intensity	1,213	1,280	1,388	1,560	1,478	1,420	1,283	1,267	1,218
Environmental									
CO2 Emissions Trend	1,000	1,285	1,268	1,478	1,642	1,840	2,013	1,964	1,928
CO2 per Capita	770	872	765	803	793	828	855	825	800
CO2 GDP Intensity	2,626	3,155	2,866	3,202	3,100	2,877	2,685	2,532	2,424
Total Index	**1,196**	**1,023**	**912**	**872**	**889**	**957**	**1,147**	**1,273**	**1,207**

Table A2-20. International Energy Security Risk Index Scores: South Korea

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,679	1,764	1,370	1,217	1,023	994	1,000	1,034	1,027
Gas Import Exposure	4,952	6,348	4,121	2,973	2,626	2,272	1,962	1,971	1,938
Coal Import Exposure	3,495	4,544	4,588	7,190	7,229	7,214	7,251	7,103	7,043
Total Energy Import Exposure	2,022	1,895	1,632	1,827	1,718	1,716	2,151	2,272	2,395
Fossil Fuel Import Expenditure per GDP	3,395	1,801	1,193	2,115	2,035	2,359	2,621	2,846	3,155
Energy Expenditures									
Energy Expenditure Intensity	1,445	766	525	893	810	1,028	1,103	1,183	1,327
Energy Expenditures per Capita	338	244	252	594	640	989	1,247	1,376	1,568
Retail Electricity Prices	1,439	952	887	888	586	550	465	460	455
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,445	2,259	701	508	1,480	1,386	1,449	1,755	1,577
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	2,064	1,769	1,440	1,224	1,123	1,018	939	926	918
Energy Use Intensity									
Energy Consumption per Capita	259	317	503	792	936	1,089	1,226	1,259	1,237
Energy Intensity	1,103	993	1,044	1,187	1,180	1,128	1,081	1,079	1,044
Petroleum Intensity	1,433	1,011	1,211	1,593	1,368	1,127	967	917	914
Electric Power Sector									
Electricity Diversity	1,207	824	741	797	873	868	920	924	984
Non-Carbon Generation	1,260	961	677	952	885	889	1,002	1,011	1,020
Transportation Sector									
Transport Energy per Capita	40	186	361	689	704	861	841	853	837
Transport Energy Intensity	172	582	748	1,032	887	893	742	731	706
Environmental									
CO2 Emissions Trend	1,000	1,308	1,838	2,895	3,330	3,748	4,411	4,638	4,553
CO2 per Capita	312	382	510	764	843	927	1,063	1,109	1,084
CO2 GDP Intensity	1,330	1,194	1,059	1,145	1,063	961	937	951	915
Total Index	**1,371**	**1,266**	**1,039**	**1,176**	**1,213**	**1,253**	**1,405**	**1,557**	**1,514**

Table A2-21. International Energy Security Risk Index Scores: Spain

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,657	1,654	1,307	1,171	1,013	979	1,006	1,040	1,032
Gas Import Exposure	5,962	5,461	3,070	2,828	2,600	2,298	2,003	2,012	1,976
Coal Import Exposure	976	1,687	1,783	2,846	3,702	4,154	3,071	5,151	5,262
Total Energy Import Exposure	2,112	1,603	1,313	1,522	1,448	1,712	1,666	1,843	1,924
Fossil Fuel Import Expenditure per GDP	1,309	747	751	860	763	1,322	1,289	1,438	1,642
Energy Expenditures									
Energy Expenditure Intensity	580	353	361	365	326	555	539	572	607
Energy Expenditures per Capita	465	295	373	400	427	793	756	804	841
Retail Electricity Prices	1,174	966	1,749	1,540	819	950	1,185	1,173	1,161
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	580	655	307	375	194	924	1,167	887	391
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	1,115	1,092	983	954	872	836	843	842	849
Energy Use Intensity									
Energy Consumption per Capita	457	488	567	615	773	834	761	742	731
Energy Intensity	568	581	548	560	588	582	541	526	527
Petroleum Intensity	786	635	600	655	646	618	531	508	480
Electric Power Sector									
Electricity Diversity	776	620	574	589	606	701	702	697	750
Non-Carbon Generation	1,001	772	676	747	812	941	668	717	769
Transportation Sector									
Transport Energy per Capita	444	513	702	788	1,043	1,167	1,078	1,099	1,082
Transport Energy Intensity	552	611	679	717	793	815	766	780	780
Environmental									
CO2 Emissions Trend	1,000	1,052	1,149	1,248	1,619	1,946	1,602	1,634	1,604
CO2 per Capita	471	482	521	558	708	790	613	624	612
CO2 GDP Intensity	586	575	504	508	539	552	436	442	441
Total Index	**1,070**	**957**	**854**	**851**	**868**	**1,002**	**1,073**	**1,235**	**1,173**

Table A2-22. International Energy Security Risk Index Scores: Thailand

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,669	1,326	1,164	1,041	772	669	589	592	569
Gas Import Exposure	6	6	4	3	177	630	394	416	374
Coal Import Exposure	360	508	246	1,000	1,468	2,223	3,064	2,887	2,724
Total Energy Import Exposure	2,637	1,364	1,273	1,347	1,047	1,091	1,085	1,139	1,195
Fossil Fuel Import Expenditure per GDP	3,710	1,453	1,438	1,732	1,452	1,864	2,434	2,766	2,967
Energy Expenditures									
Energy Expenditure Intensity	1,528	844	753	826	843	1,235	1,992	2,102	2,206
Energy Expenditures per Capita	74	48	65	103	102	182	345	364	405
Retail Electricity Prices	881	672	571	594	418	447	549	544	538
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	1,528	1,337	432	323	1,488	1,733	1,867	2,295	1,571
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	4,542	4,169	3,402	2,825	2,872	2,600	2,398	2,400	2,330
Energy Use Intensity									
Energy Consumption per Capita	60	76	125	202	232	313	366	377	371
Energy Intensity	1,242	1,317	1,441	1,608	1,910	2,115	2,103	2,172	2,015
Petroleum Intensity	2,330	1,794	1,986	2,193	2,290	2,293	2,090	1,946	1,829
Electric Power Sector									
Electricity Diversity	1,023	1,052	1,102	1,250	1,343	1,346	1,403	1,405	1,408
Non-Carbon Generation	1,324	1,227	1,295	1,326	1,354	1,373	1,372	1,271	1,177
Transportation Sector									
Transport Energy per Capita	55	83	159	305	291	374	337	344	338
Transport Energy Intensity	1,136	1,450	1,845	2,432	2,403	2,528	1,939	1,980	1,834
Environmental									
CO2 Emissions Trend	1,000	1,327	2,501	4,324	4,819	7,204	8,137	8,033	7,887
CO2 per Capita	64	77	134	222	234	333	372	366	358
CO2 GDP Intensity	1,321	1,345	1,552	1,774	1,934	2,254	2,137	2,108	1,945
Total Index	**1,319**	**1,065**	**992**	**1,069**	**1,173**	**1,340**	**1,518**	**1,667**	**1,559**

Table A2-23. International Energy Security Risk Index Scores: Turkey

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	1,460	1,544	1,157	1,073	951	932	938	974	966
Gas Import Exposure	6	6	3,869	2,897	2,513	2,234	1,970	1,981	1,945
Coal Import Exposure	838	315	946	803	1,655	1,830	1,727	1,690	1,456
Total Energy Import Exposure	1,611	1,440	1,311	1,317	1,366	1,571	1,800	1,802	1,903
Fossil Fuel Import Expenditure per GDP	1,283	834	1,024	952	1,198	1,774	2,005	2,059	2,261
Energy Expenditures									
Energy Expenditure Intensity	699	464	559	500	580	858	1,009	1,069	1,121
Energy Expenditures per Capita	142	106	153	148	194	335	433	493	522
Retail Electricity Prices	918	421	467	599	590	730	1,025	1,015	1,004
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	699	800	962	976	646	1,041	1,272	879	476
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	2,217	2,084	1,905	1,832	1,724	1,597	1,524	1,470	1,464
Energy Use Intensity									
Energy Consumption per Capita	133	152	205	239	281	310	350	381	371
Energy Intensity	654	661	745	802	836	790	812	823	795
Petroleum Intensity	840	757	766	833	749	593	519	489	463
Electric Power Sector									
Electricity Diversity	893	883	894	841	895	990	975	946	912
Non-Carbon Generation	753	957	852	834	1,081	1,086	1,059	1,075	1,091
Transportation Sector									
Transport Energy per Capita	128	142	206	251	243	247	279	281	274
Transport Energy Intensity	627	617	747	843	724	630	648	608	587
Environmental									
CO2 Emissions Trend	1,000	1,357	1,888	2,233	2,944	3,366	3,927	4,320	4,241
CO2 per Capita	141	171	217	237	289	308	337	367	355
CO2 GDP Intensity	694	743	786	794	859	786	784	793	761
Total Index	**875**	**777**	**883**	**836**	**901**	**988**	**1,158**	**1,268**	**1,194**

Table A2-24. International Energy Security Risk Index Scores: Ukraine

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	NA	NA	NA	1,462	1,280	872	881	932	955
Global Oil Production	NA	NA	NA	741	689	726	773	810	821
Global Gas Reserves	NA	NA	NA	879	998	983	932	934	971
Global Gas Production	NA	NA	NA	671	730	784	798	863	858
Global Coal Reserves	NA	NA	NA	554	582	675	686	695	695
Global Coal Production	NA	NA	NA	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	NA	NA	NA	985	694	720	731	807	796
Gas Import Exposure	NA	NA	NA	2,353	2,026	1,796	1,316	1,398	1,360
Coal Import Exposure	NA	NA	NA	1,298	372	425	1,015	511	883
Total Energy Import Exposure	NA	NA	NA	1,018	945	1,076	881	952	1,007
Fossil Fuel Import Expenditure per GDP	NA	NA	NA	8,857	6,391	7,598	5,574	5,663	6,067
Energy Expenditures									
Energy Expenditure Intensity	NA	NA	NA	9,660	7,692	7,511	7,020	7,270	7,673
Energy Expenditures per Capita	NA	NA	NA	676	510	753	760	831	881
Retail Electricity Prices	NA	NA	NA	964	706	765	870	861	852
Crude Oil Prices	NA	NA	NA	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	NA	NA	NA	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	NA	NA	NA	7,867	2,462	8,034	11,182	9,565	4,638
World Oil Refinery Usage	NA	NA	NA	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	NA	NA	NA	3,774	3,876	3,154	3,035	2,954	2,947
Energy Use Intensity									
Energy Consumption per Capita	NA	NA	NA	754	657	754	624	647	640
Energy Intensity	NA	NA	NA	10,737	9,868	7,502	5,745	5,644	5,561
Petroleum Intensity	NA	NA	NA	3,199	1,898	1,777	1,387	1,495	1,492
Electric Power Sector									
Electricity Diversity	NA	NA	NA	842	856	827	816	822	827
Non-Carbon Generation	NA	NA	NA	848	710	664	658	634	611
Transportation Sector									
Transport Energy per Capita	NA	NA	NA	236	200	240	249	256	253
Transport Energy Intensity	NA	NA	NA	3,363	3,008	2,386	2,295	2,230	2,194
Environmental									
CO2 Emissions Trend	NA	NA	NA	916	706	763	611	661	649
CO2 per Capita	NA	NA	NA	739	597	674	554	602	592
CO2 GDP Intensity	NA	NA	NA	10,533	8,970	6,701	5,102	5,252	5,146
Total Index	**NA**	**NA**	**NA**	**3,034**	**2,441**	**2,485**	**2,413**	**2,472**	**2,250**

Table A2-25. International Energy Security Risk Index Scores: United Kingdom

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	49	0	0	1,095	956	952	971	1,008	996
Gas Import Exposure	1,332	1,445	614	29	0	178	812	922	853
Coal Import Exposure	0	986	945	2,760	3,751	5,061	4,763	4,624	4,821
Total Energy Import Exposure	174	303	141	88	111	344	707	828	879
Fossil Fuel Import Expenditure per GDP	96	62	46	20	19	61	234	251	271
Energy Expenditures									
Energy Expenditure Intensity	781	446	459	400	380	416	438	457	483
Energy Expenditures per Capita	898	567	664	629	701	869	910	953	1,001
Retail Electricity Prices	1,278	776	1,092	1,007	746	922	1,108	1,097	1,085
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	781	640	580	357	120	349	894	681	316
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	931	885	830	796	735	691	692	692	693
Energy Use Intensity									
Energy Consumption per Capita	882	867	909	915	928	918	804	762	747
Energy Intensity	764	680	627	580	501	438	385	365	359
Petroleum Intensity	634	535	511	474	387	344	300	293	276
Electric Power Sector									
Electricity Diversity	1,248	1,154	1,055	986	1,033	1,040	1,061	1,056	1,091
Non-Carbon Generation	1,261	1,156	1,128	1,028	1,085	1,083	1,121	1,031	948
Transportation Sector									
Transport Energy per Capita	728	779	1,010	978	1,017	1,029	921	934	914
Transport Energy Intensity	631	610	697	620	549	491	442	447	439
Environmental									
CO2 Emissions Trend	1,000	960	981	913	913	950	862	810	795
CO2 per Capita	985	942	950	872	860	875	768	715	697
CO2 GDP Intensity	853	738	655	553	464	417	368	342	335
Total Index	**836**	**750**	**688**	**669**	**692**	**771**	**938**	**1,044**	**973**

Table A2-26. International Energy Security Risk Index Scores: United States

Metric	1980	1985	1990	1995	2000	2005	2010	2011	2012
Global Fuels									
Global Oil Reserves	1,000	1,045	1,244	1,462	1,280	872	881	932	955
Global Oil Production	1,000	909	777	741	689	726	773	810	821
Global Gas Reserves	1,000	1,365	871	879	998	983	932	934	971
Global Gas Production	1,000	1,480	927	671	730	784	798	863	858
Global Coal Reserves	1,000	1,075	688	554	582	675	686	695	695
Global Coal Production	1,000	1,033	774	790	726	978	1,283	1,360	1,361
Fuel Imports									
Oil Import Exposure	615	500	584	565	556	601	508	494	424
Gas Import Exposure	148	298	297	485	469	418	232	124	175
Coal Import Exposure	0	0	0	0	66	0	0	0	0
Total Energy Import Exposure	501	372	415	420	489	579	511	545	564
Fossil Fuel Import Expenditure per GDP	533	301	291	249	330	475	428	480	539
Energy Expenditures									
Energy Expenditure Intensity	786	586	406	321	351	455	440	473	506
Energy Expenditures per Capita	1,099	917	710	596	760	1,059	1,012	1,100	1,195
Retail Electricity Prices	786	877	724	666	573	584	645	638	631
Crude Oil Prices	1,000	614	415	292	440	700	978	1,289	1,242
Price & Market Volatility									
Crude Oil Price Volatility	1,000	489	508	214	873	837	2,617	4,328	3,169
Energy Expenditure Volatility	786	554	163	139	525	623	1,183	1,019	488
World Oil Refinery Usage	1,000	1,021	1,209	1,218	1,234	1,323	1,200	1,205	1,211
GDP per Capita	844	798	755	733	678	654	658	655	650
Energy Use Intensity									
Energy Consumption per Capita	1,929	1,803	1,901	1,920	1,967	1,906	1,780	1,753	1,718
Energy Intensity	1,376	1,148	1,084	1,031	905	815	771	751	726
Petroleum Intensity	1,278	1,005	927	854	767	719	641	622	596
Electric Power Sector									
Electricity Diversity	1,054	990	952	958	991	1,065	1,049	1,051	1,083
Non-Carbon Generation	1,118	1,059	1,012	1,000	1,035	1,051	1,023	995	967
Transportation Sector									
Transport Energy per Capita	2,324	2,290	2,442	2,539	2,669	2,739	2,469	2,505	2,451
Transport Energy Intensity	1,657	1,459	1,393	1,364	1,228	1,172	1,069	1,073	1,035
Environmental									
CO2 Emissions Trend	1,000	964	1,055	1,114	1,228	1,256	1,180	1,150	1,129
CO2 per Capita	1,899	1,749	1,825	1,805	1,878	1,835	1,647	1,592	1,552
CO2 GDP Intensity	1,354	1,114	1,041	969	864	785	713	682	656
Total Index	**1,034**	**918**	**831**	**789**	**845**	**882**	**975**	**1,081**	**999**

Table A2-27. International Energy Security Risk Index Scores for Top 75 Energy-Consuming Countries in 2010: 1980-2012 (OECD 1980=1,000)									
Country	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2011**	**2012**
OECD Group Average	1,000	866	810	776	804	891	1,044	1,164	1,073
Algeria	1,115	995	985	943	900	989	1,214	1,381	1,285
Argentina	1,075	949	921	877	885	983	1,183	1,289	1,157
Australia	825	794	715	694	745	870	977	1,112	1,029
Austria	1,137	1,019	930	896	854	1,013	1,116	1,238	1,163
Azerbaijan	-	-	-	3,732	2,293	1,903	1,380	1,928	1,754
Bahrain	1,236	1,500	1,512	1,210	1,348	1,520	1,665	1,733	1,519
Bangladesh	996	882	825	858	896	1,009	1,146	1,251	1,122
Belarus	3,034	2,489	2,294	2,674	2,122	2,016	1,818	2,033	1,858
Belgium	1,436	1,141	1,128	1,093	1,065	1,202	1,393	1,493	1,406
Brazil	1,090	844	848	823	913	936	1,139	1,310	1,248
Bulgaria	3,588	2,928	2,399	1,886	2,059	1,825	1,866	2,492	2,425
Canada	970	831	772	749	783	858	997	1,121	1,020
Chile	935	772	774	789	1,037	1,132	1,338	1,485	1,379
China	1,692	1,343	1,051	872	854	958	1,154	1,275	1,194
Colombia	750	664	583	568	588	627	765	903	805
Czech Republic	-	-	-	828	833	964	1,148	1,234	1,169
Denmark	1,302	1,021	901	875	831	870	1,023	1,139	1,050
Ecuador	921	835	811	838	913	980	1,462	1,478	1,347
Egypt	1,356	1,350	1,359	1,214	1,216	1,499	1,784	1,832	1,617
Finland	1,452	1,186	1,086	958	924	962	1,150	1,270	1,191
France	1,251	1,017	932	852	858	929	1,063	1,189	1,111
Germany	1,200	1,021	963	839	781	865	1,025	1,142	1,069
Greece	899	771	804	754	881	918	1,128	1,297	1,259
Hungary	1,032	883	846	772	776	943	1,116	1,224	1,115
India	901	830	804	818	864	928	1,064	1,226	1,138
Indonesia	765	749	666	649	748	845	1,075	1,176	1,127
Iran	1,094	1,069	1,266	1,223	1,375	1,723	2,096	2,299	2,130
Iraq	2,266	1,825	1,691	1,634	1,516	2,236	2,389	2,753	2,587
Ireland	1,184	984	912	876	974	1,046	1,170	1,300	1,218
Israel	1,376	1,278	1,070	1,059	1,150	1,174	1,368	1,429	1,366
Italy	1,192	1,060	1,032	953	990	1,079	1,192	1,312	1,208
Japan	1,319	1,168	1,003	1,000	999	992	1,167	1,307	1,245
Kazakhstan	-	-	-	1,308	1,230	1,034	1,126	1,243	1,100
Kuwait	1,097	890	879	887	1,113	1,175	1,407	1,470	1,379
Libya	1,491	1,222	1,125	1,073	1,191	1,263	1,554	1,717	1,647
Malaysia	1,095	1,053	1,091	998	1,094	1,250	1,644	1,660	1,452
Mexico	676	618	590	593	656	737	897	1,027	927

Table A2-27. International Energy Security Risk Index Scores for Top 75 Energy-Consuming Countries in 2010: 1980-2012 (OECD 1980=1,000)									
Country	1980	1985	1990	1995	2000	2005	2010	2011	2012
OECD Group Average	1,000	866	810	776	804	891	1,044	1,164	1,073
Morocco	990	875	943	994	1,073	1,106	1,437	1,508	1,409
New Zealand	828	715	725	683	710	808	942	1,065	979
Nigeria	694	711	646	683	689	664	777	912	744
North Korea	884	794	715	635	635	689	838	956	858
Norway	913	818	809	788	764	734	845	1,007	943
Oman	914	863	928	872	1,086	1,322	1,884	1,903	1,740
Pakistan	1,055	991	957	940	1,031	1,117	1,417	1,495	1,310
Paraguay	952	908	1,193	1,361	1,572	1,564	1,655	1,738	1,674
Peru	842	690	675	708	782	821	1,010	1,098	976
Philippines	1,149	920	945	1,026	1,123	1,109	1,243	1,357	1,241
Poland	1,072	956	852	821	817	875	1,112	1,221	1,104
Portugal	1,054	1,014	1,017	1,035	999	1,148	1,265	1,421	1,346
Qatar	1,943	1,392	1,318	1,426	1,410	1,622	1,537	1,599	1,426
Romania	1,233	1,033	1,156	819	823	946	960	1,152	1,000
Russia	-	-	-	1,090	1,118	1,123	1,183	1,298	1,175
Saudi Arabia	891	1,129	1,094	944	1,072	1,311	1,592	1,911	1,902
Serbia	-	-	-	-	-	-	2,020	2,150	2,060
Singapore	2,247	1,906	1,717	1,572	1,798	1,864	2,710	2,698	2,697
Slovakia	-	-	-	1,025	966	1,074	1,189	1,294	1,191
South Africa	1,166	984	868	821	844	926	1,141	1,286	1,206
South Korea	1,337	1,243	1,018	1,162	1,217	1,259	1,430	1,602	1,546
Spain	1,059	941	840	837	862	1,006	1,095	1,271	1,192
Sweden	1,332	1,130	982	916	912	938	1,107	1,229	1,149
Switzerland	1,234	1,055	928	886	853	879	1,018	1,145	1,078
Syria	1,544	1,536	1,916	1,431	1,546	1,465	1,968	1,933	1,714
Taiwan	1,134	1,010	954	1,018	1,057	1,139	1,297	1,420	1,330
Thailand	1,189	934	893	976	1,087	1,254	1,439	1,611	1,489
Trinidad and Tobago	1,031	1,242	1,036	1,127	1,206	1,614	2,058	2,175	1,924
Turkey	822	724	841	795	867	962	1,153	1,278	1,189
Turkmenistan	-	-	-	1,811	1,962	3,163	2,550	2,728	2,093
Ukraine	-	-	-	3,008	2,351	2,478	2,456	2,520	2,237
United Arab Emirates	856	1,195	1,221	1,193	1,124	1,225	1,583	1,621	1,459
United Kingdom	833	742	682	659	689	772	961	1,082	995
United States	1,041	917	829	784	852	891	1,005	1,127	1,028
Uzbekistan	-	-	-	3,877	3,249	3,254	2,897	3,110	2,346
Venezuela	1,021	973	733	709	797	815	1,030	1,190	1,068
Vietnam	859	755	812	1,013	1,160	1,212	1,472	1,550	1,391

Appendix 3: Data Sources

The Energy Institute relied primarily on government data from the Energy Information Administration (EIA) and the International Energy Agency (IEA) 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.

British Petroleum: *BP Statistical Review of World Energy*. Available at: http://www.bp.com/en/global/corporate/about-bp/statistical-review-of-world-energy-2013.html. For refinery capacity and utilization data.

Energy Information Administration:

- International Energy Statistics. Available at: http://www.eia.doe.gov/countries/data.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. For population, gross domestic product, net energy imports, electricity generation by energy source, and transport energy.

Endnotes

1

2 OECD membership has changed over the years. To ensure comparisons are made against a common baseline, OECD is defined here as a fixed set of geographic boundaries comprised of 2012 OECD members, and includes East Germany prior to German reunification in 1990. Thus, for example, Slovenia joined OECD 21 July 2010, but is counted here as part of the OECD going back to the 1980 start for the International Index.

3 Excludes the Russian Federation and the Ukraine, for which data begin in 1992. Russia's 2012 risk score is slightly higher than its 1992 score and the Ukraine's is lower.

4 The 2013 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.

5 EIA. 2013. Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States. Available at: http://www.eia.gov/analysis/studies/worldshalegas/.

6 For more on these aspects of Canada's energy security, see: Green, K.P. and S.D. Eule. 2013. Risks to Canada's Energy Security. Fraser Institute. Available at: http://www.fraserinstitute.org/research-news/display.aspx?id=19798.

7 CRS. 2011. U.S. Fossil Fuel Resources: Terminology, Reporting, and Summary. CRS Report for Congress R40872. Available at: http://www.fas.org/sgp/crs/misc/R40872.pdf.

8 IEA. 2012.World Energy Outlook 2012. Available at: http://www.iea.org/publications/freepublications/publication/English.pdf.

9 A technically-recoverable resource is a broad measure of potential value, which is different from a "technically recoverable reserve," which has actual value and can be extracted.

10 These are down from the original targets of 10 gigawatts of offshore wind in 2020 and 25 gigawatts in 2030.

11 IEA. 2013. Southeast Asia Energy Outlook, World Energy Outlook Special Report. Available at: http://www.iea.org/publications/freepublications/publication/SoutheastAsiaEnergyOutlook_WEO2013SpecialReport.pdf.

12 The International Index only looks at carbon dioxide emissions from energy. Indonesia is also a very large emitter of carbon dioxide from deforestation.

13 EIA's international database is available: <http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm>. EIA's sources are listed at: <http://www.eia.gov/cfapps/ipdbproject/docs/sources.cfm>.

14 Although OECD membership has changed over its 50-plus year history, the OECD averages over the entire period from 1980 through 2010 were calculated using the current roster of OECD members. OECD membership today includes: Australia, Austria, Belgium, Canada, Chile, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Slovak Republic, Slovenia, South Korea, Spain, Sweden, Switzerland, Turkey, United Kingdom, and United States. Because OECD is used as the baseline against which other countries are compared, the list of OECD countries needed to remain fixed over time.

15 It should be noted that the 1980 level is not a cap—the scale is open-ended at the top.

Notes

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