

Appendix A

Methodology

Instability of Supplier Country:

The Foreign Policy *Failed States Index* rates countries on 12 categories: demographic pressures, refugees/IDPs, group grievance, human flight, uneven development, economic decline, delegitimization of state, public services, human rights, security apparatus, factionalized elites, and external intervention. Each category is rated 1-10, with 10 being the worst score. For this scorecard, we used the average score for each of the countries from which the U.S. imports each fuel source.

The Economists’ *Political Instability Index* rates countries on two categories: underlying vulnerability and economic distress. Each category is rated out of 10, with 10 being the worst score. The “Index Score” – or the final score given by the Economist – is the average of the two categories and the same score used for this metric here.

The two categories in this metric were averaged and then multiplied by the percentage of imports to the U.S. to give a final rating for each country. Those ratings were summed to produce a final score in each category.

For oil, because of its unique characteristics as a global commodity controlled by a producer oligopoly, where a significant threat comes from disruption to reserves and not simply the countries we import from, we intend to create a weighted score for countries with major oil reserves in the next version of this scorecard. We will also provide weighted scores for countries from which we can expect growth in the natural gas, electricity, and ethanol markets. However, we believe that such a weight will simply worsen oil’s standing, while maintaining the rankings here.

For electricity, we calculated the score based on the origin of the source used to produce electricity. The majority of the United States’ electricity supply is generated from domestic sources. However, oil and natural gas account for a percentage of U.S. electricity generation. Therefore, the final scores in this category for oil and natural gas were multiplied by the percentage of electricity created by those commodities generate a final raw score. These raw scores were then summed to give a final category score.

The calculations for each of the categories follow:

Electricity		Percentage of U.S. Supply ¹	Raw Score
Oil	3.37	0.7%	0.02
Natural Gas	0.45	23.3%	0.10
Remainder	0	76%	0
TOTAL:			0.12

¹ U.S. Energy Information Administration. “Net Generation by Energy Source: Total (All Sectors).” Retrieved September 13, 2010 from: http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html.

Top Ethanol Suppliers	Foreign Policy	Economist	Average	Percentage of U.S. Supply ²	Raw Score
U.S.A.	2.9	5.3	4.1	98%	0
Jamaica	5.6	6.0	5.8	1%	0.06
Trinidad and Tobago	5.5	4.7	5.1	0.5%	0.02
El Salvador	6.6	5.2	5.9	0.3%	0.02
Costa Rica	4.3	3.5	3.9	0.1%	0.00
Canada	2.3	2.8	2.6	0.1%	0.00
TOTAL:					0.10

Top Natural Gas Suppliers	Foreign Policy	Economist	Average	Percentage of U.S. Supply ³	Raw Score
U.S.A.	2.9	5.3	4.1	85%	0
Canada	2.3	2.8	2.6	13%	0.34
Trinidad	5.5	4.7	5.1	1%	0.05
Egypt	7.3	5.4	6.3	0.6%	0.04
Norway	1.6	1.2	1.4	0.1%	0.00
Mexico	6.3	6.1	6.2	0.1%	0.01
Nigeria	8.3	7.0	7.6	0.1%	0.01
Qatar	4.3	4.1	4.2	0.1%	0.00
TOTAL:					0.45

² U.S. Energy Information Administration. "U.S. Imports by Country of Origin." Retrieved September 10, 2010 from: http://www.eia.doe.gov/dnav/pet/pet_move_impcus_a2_nus_epooxe_im0_mbb1_a.htm.

³ U.S. Energy Information Administration. "U.S. Natural Gas Imports by Country." Retrieved August 31, 2010 from: http://www.eia.gov/dnav/ng/ng_move_impc_s1_a.htm.

Top U.S. Oil Suppliers	Foreign Policy ⁴	Economist ⁵	Average	Percentage of U.S. Supply ⁶	Raw Score
U.S.	2.9	5.3	4.1	41%	0
Canada	2.3	2.8	2.6	15%	0.39
Mexico	6.3	6.1	6.2	9%	0.56
Saudi Arabia	6.5	6.1	6.3	8%	0.50
Venezuela	6.6	7.3	6.9	8%	0.55
Nigeria	8.3	7.0	7.6	5%	0.38
Angola	7.0	7.6	7.3	4%	0.29
Iraq	8.9	7.9	8.4	3.5%	0.29
Brazil	5.6	5.4	5.5	2.5%	0.14
Russia	6.6	6.5	6.5	2%	0.13
Colombia	7.3	7.0	7.1	2%	0.14
TOTAL:					3.37

Opposes American Values:

Freedom House's *Freedom in the World* survey rates countries on two categories: political rights and civil liberties. Each category is rated 1-7, with 7 being the worst rating. As stated in our report, these rankings have also been found to be the only ranking system correlated with global terrorism, due to the relationship between autocracies and terrorist movements.

For our metric, we took the average of the two ratings and weighted it by multiplying the average by the percentage of U.S. supply. The raw scores for each country were then summed for a final category score.

For electricity, we calculated the score based on the origin of the source used to produce electricity. The majority of U.S. electricity supply is generated by using sources that are domestic. However, oil and natural gas account for a percentage of U.S. electricity generation. Therefore, the final scores in this category for oil and natural gas were multiplied by the percentage of electricity those commodities are used to create to give a final raw score.

The calculations for each metric follow:

⁴ Foreign Policy, "The Failed States Index 2010." Retrieved September 13, 2010 from: <http://www.foreignpolicy.com/failedstates>.

⁵ The Economist, "Political Instability Index." Retrieved September 13, 2010 from: http://viewswire.eiu.com/site_info.asp?info_name=social_unrest_table&page=noads&rf=0.

⁶ U.S. Energy Information Administration. "Crude Oil and Total Petroleum Imports Top 15 Countries." Retrieved September 10, 2010 from: http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/company_level_imports/current/import.html.

Electricity		Percentage of U.S. Supply	Raw Score
Oil	1.96	0.7%	0.01
Natural Gas	0.06	23.3%	0.01
Remainder	0	76%	0.00
TOTAL:			0.02

Top Ethanol Suppliers	Political Rights	Civil Liberties	Average	Percentage of U.S. Supply	Raw Score
U.S.A.	1	1	1	98%	0
Jamaica	2	3	2.5	1%	0.02
Trinidad and Tobago	2	2	2	0.5%	0.01
El Salvador	2	3	2.5	0.3%	0.01
Costa Rica	1	1	1	0.1%	0.00
Canada	1	1	1	0.1%	0.00
TOTAL:					0.04

Top Natural Gas Suppliers	Political Rights	Civil Liberties	Average	Percentage of U.S. Supply	Raw Score
U.S.A.	1	1	1	85%	0
Canada	1	1	1	13%	0
Trinidad	2	2	2	1%	0.02
Egypt	6	5	5.5	0.6%	0.03
Norway	1	1	1	0.1%	0.00
Mexico	2	3	2.5	0.1%	0.00
Nigeria	5	4	4.5	0.1%	0.00
Qatar	6	5	5.5	0.1%	0.01
TOTAL:					0.06

Top U.S. Oil Suppliers	Political Rights ⁷	Civil Liberties	Average	Percentage of U.S. Supply	Raw Score
U.S.	1	1	1	41%	0
Canada	1	1	1	15%	0
Mexico	2	3	2.5	9%	0.22
Saudi Arabia	7	6	6.5	8%	0.52
Venezuela	5	4	4.5	8%	0.36
Nigeria	5	4	4.5	5%	0.22
Angola	6	5	5.5	4%	0.22
Iraq	5	6	5.5	3.5%	0.19
Brazil	2	2	2	2.5%	0.05
Russia	6	5	5.5	2%	0.11
Colombia	3	4	3.5	2%	0.07
TOTAL:					1.96

Climate Disruption:

The California Air Resources Board completed a comprehensive analysis of the carbon emissions rates for each of the sources used in our scorecard. For our metric, we began with the average “Direct Emissions” score from the California Air Resources Board’s study. The highest score in the study was 142.10. Therefore, we divided the average Direct Emissions figure by 14.21 to bring the final scores for this category into the same scale with our other metrics.

Lifecycle costs also contribute to each fuels overall carbon intensity. Extraction, transportation, and inputs such as fertilizer and fuel to create each energy source must be taken into account for a comprehensive analysis of each fuel’s climate disruption. In version 2.0 of this report we will determine metrics that account for the full lifecycle carbon costs of each fuel.

Fuel Source ⁸	TOTAL (gCO ₂ e/MJ)	Raw Score (TOTAL/14.21)
Electricity	114.40	8.05
Ethanol	55.37	3.90
Natural Gas	50.58	3.56
Oil	95.86	6.74

Possible Threat to Supply Chain:

⁷ Freedom House, “Freedom in the World 2010.” Retrieved August 31, 2010 from: http://www.freedomhouse.org/uploads/fiw10/FIW_2010_Tables_and_Graphs.pdf.

⁸ California Air Resources Board, “Carbon Intensity Lookup Table for Gasoline and Fuels that Substitute for Gasoline.” Retrieved September 13, 2010 from: http://www.arb.ca.gov/fuels/lcfs/121409lcfs_lutables.pdf.

In this metric, the percentage of U.S. supply was rated on a point scale to account for the distance each source must travel to reach U.S. markets and the method of travel for each source. The greater the distance each source has to travel to reach U.S. consumers, the greater the amount of points assigned on the scale.

A further weight of 0.5 points was assigned to the electricity source to account for the significant grid reliability issues faced in America.

In a later version of this scorecard, we will also account for the number of volatile chokepoints each source must pass through. Oil supplies, for example, are affected by their transit vulnerability. Chokepoints such as the Straits for Hormuz and the Straits of Malacca threaten supply levels; the future inclusion of such factors will strengthen this category in a subsequent version. However, we believe that this additional weight will remain in keeping with these findings, as oil must transit through the most chokepoints, while ethanol, natural gas, and electricity all have more significant domestic production components. The calculations for this metric follow:

Electricity		Percentage of U.S. Supply	Raw Score
Oil	3.72	0.7%	0.03
Natural Gas	0.58	23.3%	0.13
Remainder	0	76%	0.0
TOTAL: 0.66 (+ 0.5 to account for grid reliability issues)=			0.66

U.S. Ethanol Suppliers (Country)	Percentage	U.S. Ethanol Sources (Score System)	Percentage	Point Value	Raw Score
U.S.A.	98%	U.S.A.	98%	0	0
Jamaica	1%	N. America	0.1%	3	0.003
Trinidad and Tobago	0.5%	S. America	1.9%	6	0.114
El Salvador	0.3%	World	0%	10	0
Costa Rica	0.1%				0.117
Canada	0.1%				0.12
	100%				

U.S. Natural Gas Suppliers (Country)	Percentage	U.S. Natural Gas Sources (Score System)	Percentage	Point Value	Raw Score
U.S.A.	85%	U.S.A.	85%	0	0
Canada	13%	N. America	13.1%	3	0.39
Trinidad	1%	S. America	0%	6	0
Egypt	0.6%	World	1.9%	10	0.19
Norway	0.1%				0.58
Mexico	0.1%				
Nigeria	0.1%				
Qatar	0.1%				

U.S. Oil Suppliers(Country)	Percentage	U.S. Oil Sources (Score System)	Percentage	Point Value	Raw Score
U.S.	41%	U.S.A.	41%	0	0
Canada	15%	N. America	24%	3	0.72
Mexico	9%	S. America	12.5%	6	0.75
Saudi Arabia	8%	World	22.5%	10	2.25
Venezuela	8%				3.72
Nigeria	5%				
Angola	4%				
Iraq	3.5%				
Brazil	2.5%				
Russia	2%				
Colombia	2%				

Cost Spike Volatility:

The volatility of cost increases from year to year was compared over the past ten years for each source. The total percentage for each source was summed and divided by ten to produce a final category score.

In the next version of the scorecard we intend to use a longer data set in this category to produce an even more comprehensive view of pricing changes. However, we can anticipate that even a broader view will show similar trends and produce similar scores. The calculations for this category follow:

Electricity	Price ⁹	Percentage Change
1999	9.4	N/A
2000	9.3	-1%
2001	9.46	2%
2002	9.16	-3%
2003	9.27	1%
2004	9.25	0%
2005	9.45	2%
2006	10.07	7%
2007	10.03	0%
2008	10.38	3%
2009	10.52	1%
		12%
(12/10)=		1.20

Ethanol	Price ¹⁰	Percentage Change
1999	0.98	N/A
2000	1.35	38%
2001	1.48	10%
2002	1.12	-24%
2003	1.35	21%
2004	1.69	25%
2005	1.80	7%
2006	2.58	43%
2007	2.24	-13%
2008	2.47	10%
2009	1.79	-28%
		89%
(82.7/10)=		8.90

⁹ U.S. Energy Information Administration, "Annual Energy Review 2009," Table 8.10. Retrieved September 15, 2010 from: <http://www.eia.doe.gov/aer/pdf/aer.pdf>.

¹⁰ Official Nebraska Government Website, "Ethanol and Unleaded Gasoline Average Rack Prices." Retrieved September 13, 2010 from: <http://www.neo.ne.gov/statshhtml/66.html>.

Natural Gas	Price ¹¹	Percentage Change
1999	2.52	N/A
2000	4.15	65%
2001	4.41	6%
2002	3.20	-27%
2003	5.19	62%
2004	5.64	9%
2005	7.33	30%
2006	6.19	-16%
2007	5.88	-5%
2008	7.34	25%
2009	3.38	-54%
		95
(95/10)=		9.50

Oil	Price ¹²	Percentage Change
1999	23.14	N/A
2000	35.50	53%
2001	29.61	-17%
2002	29.84	1%
2003	33.62	13%
2004	43.46	29%
2005	59.89	38%
2006	69.32	16%
2007	74.90	8%
2008	96.91	29%
2009	61.67	-36%
		134%
(134/10)=		13.40

¹¹ U.S. Energy Information Administration, "Annual Energy Review 2009," Table 6.7. Retrieved September 13, 2010 from: <http://www.eia.doe.gov/aer/pdf/aer.pdf>.

¹² BP Statistical Review of World Energy 2010. Retrieved August 31, 2010 from: <http://www.bp.com/productlanding.do?categoryId=6929&contentId=7044622>.