I. Introduction

Imagine: one cubic mile of oil.

One cubic mile of oil—or CMO—represents the world's current annual oil consumption. One CMO would fill the volume of 1,000 sports arenas. One CMO converts to approximately 26 billion barrels of oil, or 1.1 *trillion* gallons. In terms of energy equivalence, a cubic mile of oil yields 153 quadrillion (10^{15}) Btu's—one Btu being approximately equal to the energy released by burning a match.[1]

Replacing the energy yield from 1 CMO would require the output of 104 coal-fired plants operating continuously for 50 years, or four Three Gorges Dams producing hydroelectric power each year for 50 years. 32,850 wind turbines, or 52 nuclear power plants, or 91,250,000 solar panels (each running for 50 years) would be needed to match the energy output of 1 CMO.[2]

Today, because of its outstanding energy density (the amount of energy per unit of volume of a fuel), oil accounts for roughly one-third of the global energy mix. Coal and natural gas are the other main traditional sources of energy. Together, oil, coal, and natural gas satisfy over 79 percent of the world's total requirement for power. "Alternative" sources of energy, such as geothermal, solar, biomass, and wind satisfy only 1 percent of the world's energy demand. The remaining supply is provided by nuclear and hydroelectric power generation.

Thoughtful observers have argued that regional energy consumption is a function of affluence, not population, and that what drives relatively greater North American and European energy demand—when compared to per-capita demand from developing regions such as Africa or Central America—is greater economic development.

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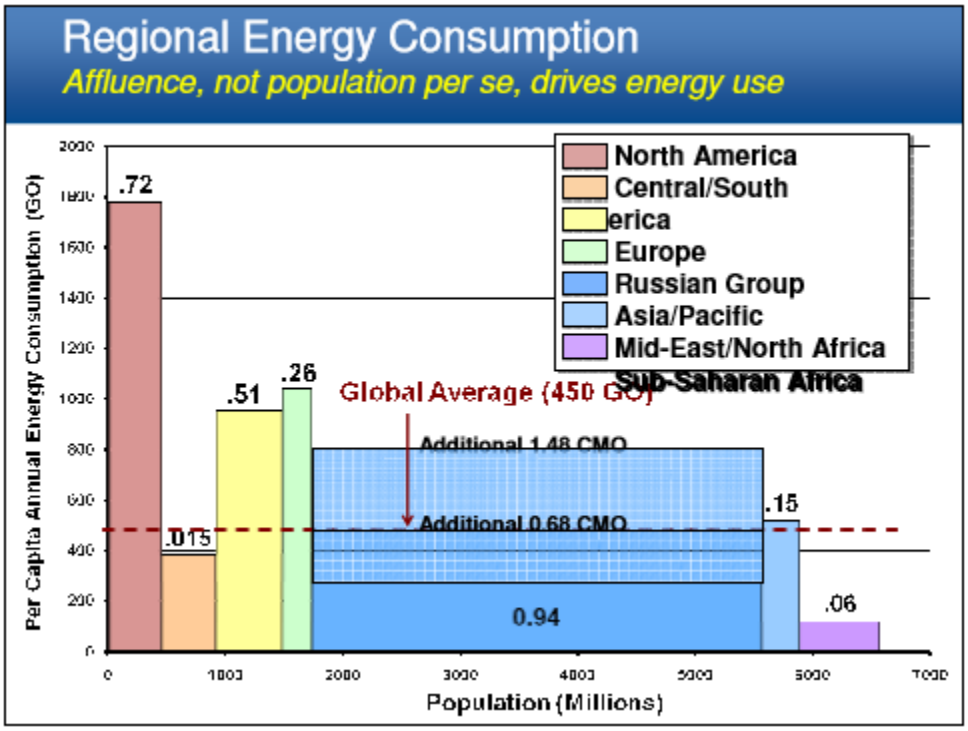
[1] Ripudaman Malhotra, "A Cubic Mile of Oil: Realities and Options for Averting the Global Energy Crisis," SRI International, August 5, 2009, http://global.oup.com/us/companion.websites/9780195325546/pdf/Jr_Statesman_Sympsm_Energy.pdf.

[2] Harry Goldstein and William Sweet, "Joules, BTUs, Quads—Let's Call the Whole Thing Off: How to replace a cubic mile of oil," *IEEE Spectrum*, January 1, 2007, https://spectrum.ieee.org/energy/fossil-fuels/joules-btus-quads-lets-call-the-whole-thing-off.



Source: SRI International

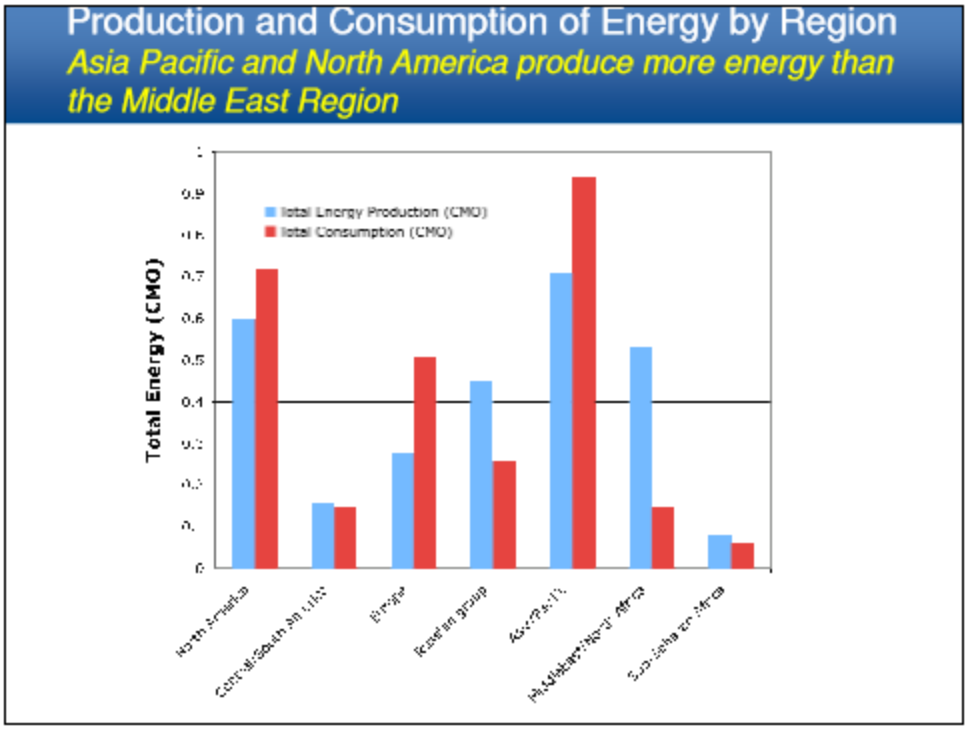
Worldwide demand for energy is growing at roughly 2.5 percent year-over-year. The global demand for energy from all sources now is about 3.0 CMO. By mid-century, demand is expected to reach 9.0 CMO, stimulated by countries with near-double-digit GDP growth rates, such as China and India—countries that also have large populations spread out over large geographic areas.[3]

Yellow Team has been interested to compare a sampling of countries to identify relationships that may exist between energy consumption and generation, and other factors such as economic development (for which we considered population health a proxy), type of government, population size and landmass area.

[3] Malhotra.

II. Design

Malhotra, in his previously cited "A Cubic Mile of Oil" presentation, provided the following chart:

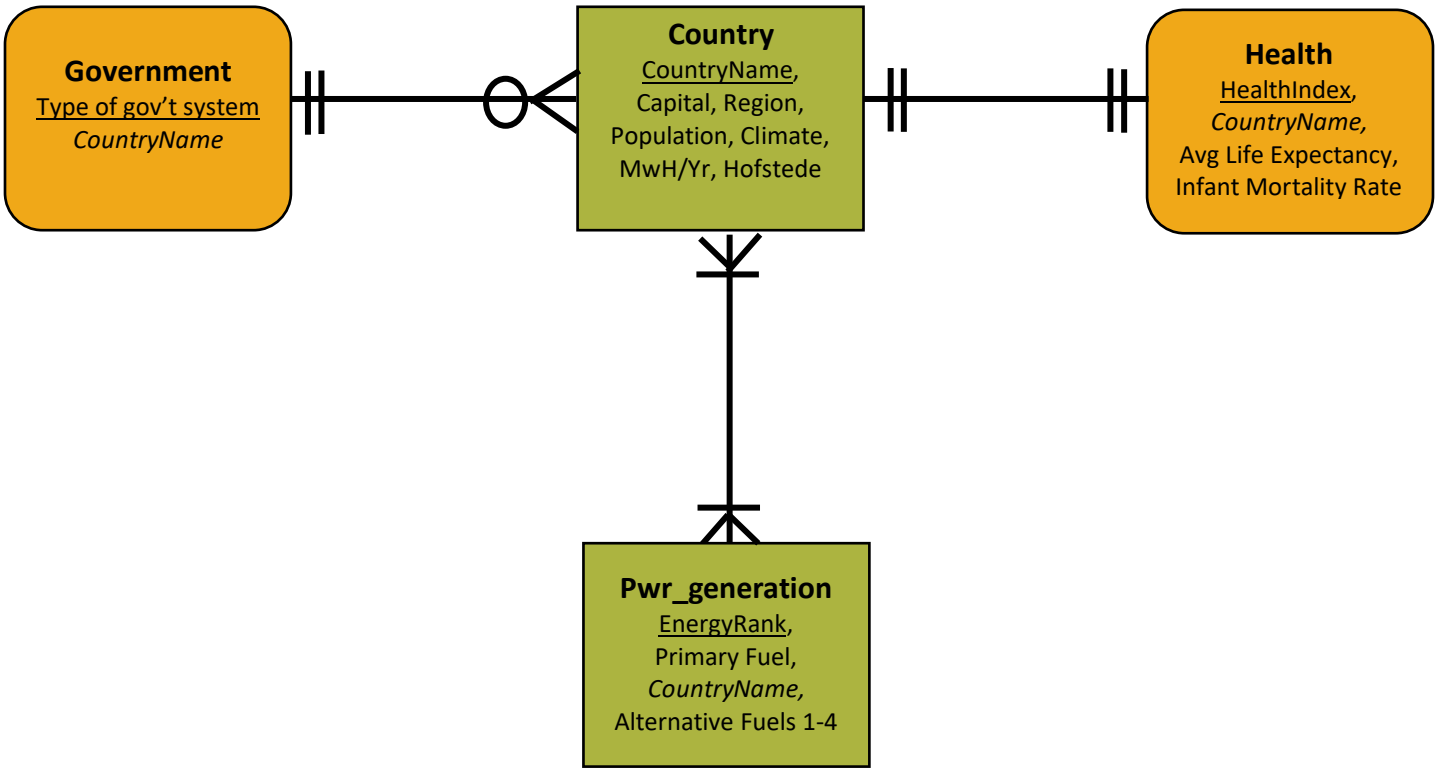


Source: SRI International

The independent (X-axis) variables are geographic regions (labeled from left to right): North America, Central/South America, Europe, Russian Group, Asia/Pacific, Mideast/North Africa, and Sub-Saharan Africa. The dependent (Y-axis) variable is total energy measured in CMO. Blue bars represent total energy production; red bars show energy consumption.

The absolute values for energy production and consumption are not as interesting to Yellow Team as are the relative comparisons between the geographic regions. Our group created an entity-relationship (E-R) data model to better understand the relationships implied by the Malhotra charts, and to hypothesize about the importance of certain factors commonly

associated with economic advancement in determining a county's annual energy usage. The Yellow Team data model conceptual design is represented by the following E-R diagram:



The Yellow Team E-R diagram uses "crow's foot" symbology to indicate minimum and maximum cardinalities between entity classes. Also, we have retained conventions from the Kroenke Database Processing, 14th ed. textbook to represent strong and weak entities, and the relationships between entities. Rounded corners on boxes indicate entities that are ID-dependent; squared corners show non-ID-dependent entities. Strong entities, which may exist as objects on their own, are colored green. Weak entities whose existence depends on the presence of another entity are mustard-colored. Solid lines connecting boxes indicate an ID-dependent relationship in which the "child" entity depends upon a "parent" entity; dashed lines between strong entities refer to non-identifying relationships.

It's important to explain the assumptions made by Yellow Team in creating the conceptual schema: Countries are, of course, political entities dependent for their legitimacy on recognition by their own population plus other polities. However, we consider countries as entities that exist independent of other entities in our model, and are therefore classified as strong entities. Arguably, we have assumed that energy production is independent of a country as a political entity. While it's certain that energy production must occur *someplace*, we considered Power Generation as a physical process rather than as the attribute of a polity. In our schema, we have labeled Power Generation as a strong entity. The relationship between Country and Power Generation is therefore a "HAS-A" relationship: Each country has a capacity for generating power, and every plant for power generation has a physical (though not necessarily fixed or permanent) location. One country may have many sources for power generation, just as one method of power generation may be common to many countries. All countries require some method of producing energy.

"HAS-A" relationships are assumed in the identifying relationships between Country and Government, and between Country and Health. A country has one, and only one, form of government. A country has only one population health ranking. Multiple countries can share the same relative health assessment, but each country will have some level of health. Likewise, a generalized form of government (monarchy, theocracy, oligarchy, democracy…) can be common to various countries. Some forms of government (capracracy, epistemocracy…) do not exist in any of our sampled countries; therefore, are represented by a "0" minimum cardinality.

Those are the conventions. Regarding assumptions particular to each entity class or data table, the following apply:

Country

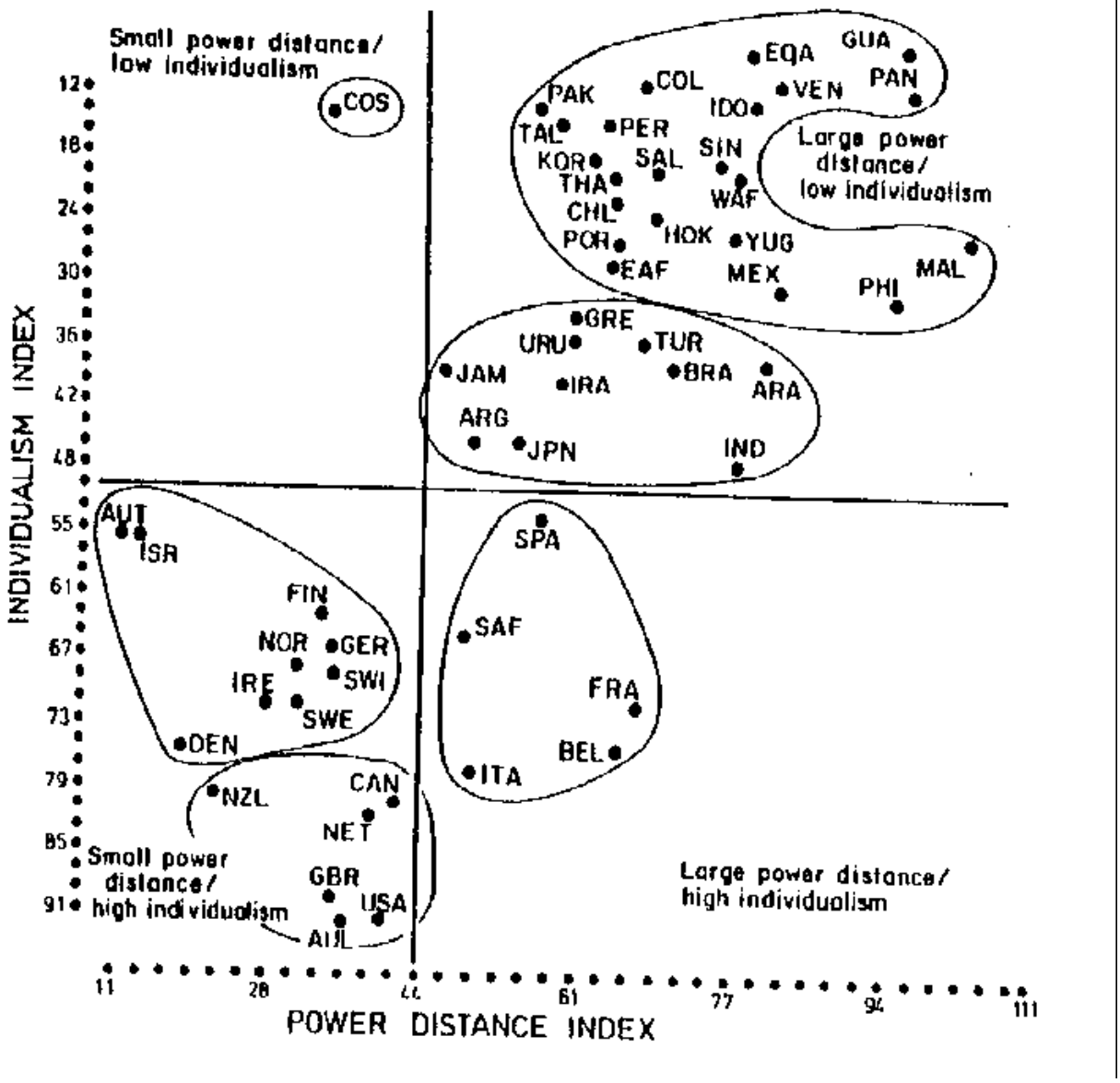
- Each country is unique. There are no duplicate country names.
- Capital names and continents may be common among countries.
- Population is a required attribute for each country, and could provide an alternative explanation from Malhotra's for energy demand growth.
- Climate may be related to energy demand, government type, and population health; however, without statistical correlation data, we chose to ignore climate as a causal factor in determining economic development.

- Power Distance v. Individualism could be strongly correlated with economic progress.[4]

IBM researcher Geert Hofstede, in his seminal work, Culture's Consequences, provided a methodology for cross-cultural study that revealed five main dimensions on which country cultures differ:

- "Power distance is the extent to which the less powerful members of organizations and institutions accept and expect that power is distributed unequally. The basic problem involved is the degree of human inequality that underlies the functioning of each particular society."
- "Uncertainty avoidance is the extent to which a culture programs its members to feel either uncomfortable or comfortable in structured situations…. The basic problem involved is the degree to which a society tries to control the uncontrollable."
- "Individualism on the one side versus its opposite, collectivism, is the degree to which individuals are supposed to look after themselves or remain integrated into groups around the family. Positioning itself between these poles is very basic problem all societies face."
- "Masculinity versus its opposite, femininity, refers to the distribution of emotional roles between the genders, which is another fundamental problem for any society for which a range of solutions are found…"
- "Long-term versus short-term orientation refers to the extent to which a culture programs its members to accept delayed gratification of their material needs."

[4] Geert Hofstede, *Culture's Consequences* (Thousand Oaks, CA: Sage Publications, 2001) 79-278.



Source: Hofstede

In our assumptions, Yellow Team regarded Hofstede's Small Power Distance / High Individualism versus Large Power Distance / Low Individualism combined index as an approximate measure of the level of economic opportunity that existed for individuals in each country. Our relative score for this measure was derived by subtracting the Power Distance Index value from the Individualism Index value, which we refer to as the "Hofstede Index," or

just "Hofstede." Due to the limited scope of this report, Yellow Team disregarded Hofstede's factors of Uncertainty Avoidance, Masculinity-Femininity, and Individualism-Collectivism.[5]

Government

- Each country has one government type. Government types are not unique.
- Type of government is related to economic development.

Health

- Population health is measured by Infant Mortality Rate.
- Population health is measured by Average Life Expectancy.
- A combination of Infant Mortality and Life Expectancy provide an overall ranking.
- Every country has a ranking; countries may share a relative ranking.
- Country factors such as government, climate, and energy usage affect health; however, we did not calculate these factors as part of our HealthIndex. HealthIndex was derived by dividing Average Life Expectancy by Infant Mortality Rate.
- Population health is an indicator of economic progress.

Pwr_generation

- Each country has a primary source of power generation.
- Alternative sources of power generation may support marginal demand.
- Fossil fuels, particularly oil, remain the primary energy source worldwide.
- Power generation roughly equates to productive energy consumption, and is an indicator of economic progress. Energy consumption is measured in MwH/Yr. (Energy efficiency or waste is not considered; however, Malhotra argued that energy conservation was the "low hanging fruit" to meeting demand growth between now and 2050.).
- Energy consumption is an indicator of economic progress.

[5] Ibid.

From the E-R diagram and assumptions listed above, Yellow Team prepared the following entity designs. The primary key is underlined; foreign keys are italicized:

COUNTRY(CountryName, CountryCode, Capital, Region, CountryPopulation, Climate, MwH/Yr, Hofstede)
GOVERNMENT(TypeCode, *CountryName,* GovType)
HEALTH(HealthIndex, *CountryName,* AvgLifeExp, InfantDeaths)
PWR_GENERATION(EnergyRank, *CountryName,* FossilFuel, NuclearPower, WaterPower, RenewableEnergy, OtherEnergyResources)

III. Implementation

Data tables were developed for each of the entity designs listed above:

COUNTRY

Data Element	Data Type	PK	Null Status	Comments
CountryName	Varchar (50)	PK	Not Null	
CountryCode	Varchar(2)		Not Null	Unique, AK
Capital	Varchar (50)		Not Null	
Region	Char (20,0)		Not Null	
CountryPopulation	Numeric (25)		Not Null	
Climate	Varchar (25)		Null	
MwH/Yr	Numeric(20,0)		Not Null	
Hofstede	Int		Null	
TypeCode	Int		Not Null	FK

GOVERNMENT

Data Element	Data Type	PK	Null Status	Comments
TypeCode	Int	PK	Not Null	
GovType	Varchar (50)		Not Null	Unique, AK
CountryName	Varchar (50)		Not Null	FK

HEALTH

Data Element	Data Type	PK	Null Status	Comments
HealthIndex	Decimal (5,3)	PK	Not Null	
CountryName	Varchar (50)		Not Null	FK
AvgLifeExp	Decimal (5,1)		Not Null	
InfantDeaths	Decimal (5,4)		Not Null	

PWR_GENERATION

Data Element	Data Type	PK	Null Status	Comments
EnergyRank	Int	PK	Not Null	
CountryName	Varchar (50)		Not Null	FK
FossilFuel	Float		Null	
NuclearPower	Float		Null	
WaterPower	Float		Null	
OtherEnergyRes	Float		Null	
RenewableEnergy	Float		Null	

During implementation of the data tables, a number of small changes were made from the original data plan, which are not reflected in the resultant tables shown above, and which mainly involved changing data types and null status. The original plan was an attempt at the "Straight-to-BCNF" normalization method, whereby every determinant was to be a candidate key. However, a significant normalization problem that is indicated in the tables above in red text was found with the design for the Government table: We first set (Government) TypeCode to be our primary key and CountryName to be our foreign key, but realized that we had multiple countries with the same GovType. For example, Egypt, Algeria, and Chad all have TypeCode #4, a Presidental Republic GovType. To eliminate this multivalued dependency, Yellow Team removed CountryName altogether from the Government data table, but kept TypeCode as the primary key. TypeCode, which was not in the original table design for the Country table, was added to that table as a foreign key.

The revised data plan was as follows:

COUNTRY(CountryName, *TypeCode*, CountryCode, Capital, Region, CountryPopulation, Climate, MwH/Yr, Hofstede)

GOVERNMENT(TypeCode, GovType)

HEALTH(HealthIndex, *CountryName*, AvgLifeExp, InfantDeaths)

PWR_GENERATION(EnergyRank, *CountryName*, FossilFuel, NuclearPower, WaterPower, RenewableEnergy, OtherEnergyResources)

Using SQL program statements, each of the data tables were constructed in the Data Base Management System (DBMS):

CREATE TABLES FIN...5N43IN\Scott (51))

```
CREATE TABLE GOVERNMENT (
TypeCode            Int             NOT NULL,
GovType             Varchar(50)     NOT NULL Unique,
CONSTRAINT TypeCodePK Primary Key (TypeCode),
);

CREATE TABLE COUNTRY (
CountryName         Varchar(50)     NOT NULL,
CountryCode         Char(2)         NOT NULL Unique,
Capital             Varchar(50)     NOT NULL,
Region              Char(25)        NOT NULL,
CountryPopulation   Numeric(20,0)   NOT NULL,
Climate             Varchar(25)         NULL,
MwH_Yr              Numeric(20,0)           NOT NULL,
Hofstede            Int                  NULL,
TypeCode            Int             NOT NULL,
CONSTRAINT CountryNamePK Primary Key (CountryName),
CONSTRAINT TypeCodeFK Foreign Key (TypeCode) REFERENCES GOVERNMENT(TypeCode)
);
```

CREATE TABLES FIN...5N43IN\Scott (51))

```
CREATE TABLE HEALTH (
HealthIndex         Decimal(5,3)        NOT NULL,
CountryName         Varchar(50)         NOT NULL,
AvgLifeExp          Decimal(5,1)        NOT NULL,
InfantDeaths        Decimal(5,4)        NOT NULL,
CONSTRAINT HealtIndexPK Primary Key (HealthIndex),
CONSTRAINT CountryNameFK2 Foreign Key (CountryName) REFERENCES COUNTRY(CountryName)
);


CREATE TABLE PWR_GENERATION (
EnergyRank              Int             NOT NULL,
CountryName             Varchar(50)     NOT NULL,
FossilFuel              Float            NULL,
NuclearPower            Float            NULL,
WaterPower              Float            NULL,
RenewableEnergy         Float            NULL,
OtherEnergyResources    Float            NULL,
CONSTRAINT EnergyRankPK Primary Key (EnergyRank),
CONSTRAINT CountryNameFK Foreign Key (CountryName) REFERENCES COUNTRY(CountryName)
);
```

As sources of data for the tables, Yellow Team relied on the following:

- Country names and capitals were copied from Wikipedia.[6] Countries were selected at random according to regional groupings.
- Region descriptions were as in the Malhotra/SRI International "A Cubic Mile of Oil" report.[7]
- Country population count was from Wikipedia, referencing source data from the United Nations Department of Economic and Social Development. [8]
- Climate date by country was from the World Bank.[9]
- Energy data by country was from Worlddata.info.[10] Also, World Bank data was copied.[11] By-country energy ranking was from the Nationmaster online database.[12]
- Cultural data from Hofstede/IBM research used by Yellow Team to derive our own "Hofstede Index" was published by Geert Hofstede in the book Culture's Consequences. Yellow Team wants to reiterate that the "Hofstede" values in our Country table were created by our team by multiplying Hofstede's Individualism Index values for each study country by the Power Distance Index values.[13]
- Government Type data was copied from the CIA World Factbook, accessed online through teacherlink.ed.usu.edu.[14] Additional information was from Index Mundi World Factbook online.[15]
- Government table TypeCode data were counting numbers assigned by Yellow Team to each of the government types from the CIA World Factbook.

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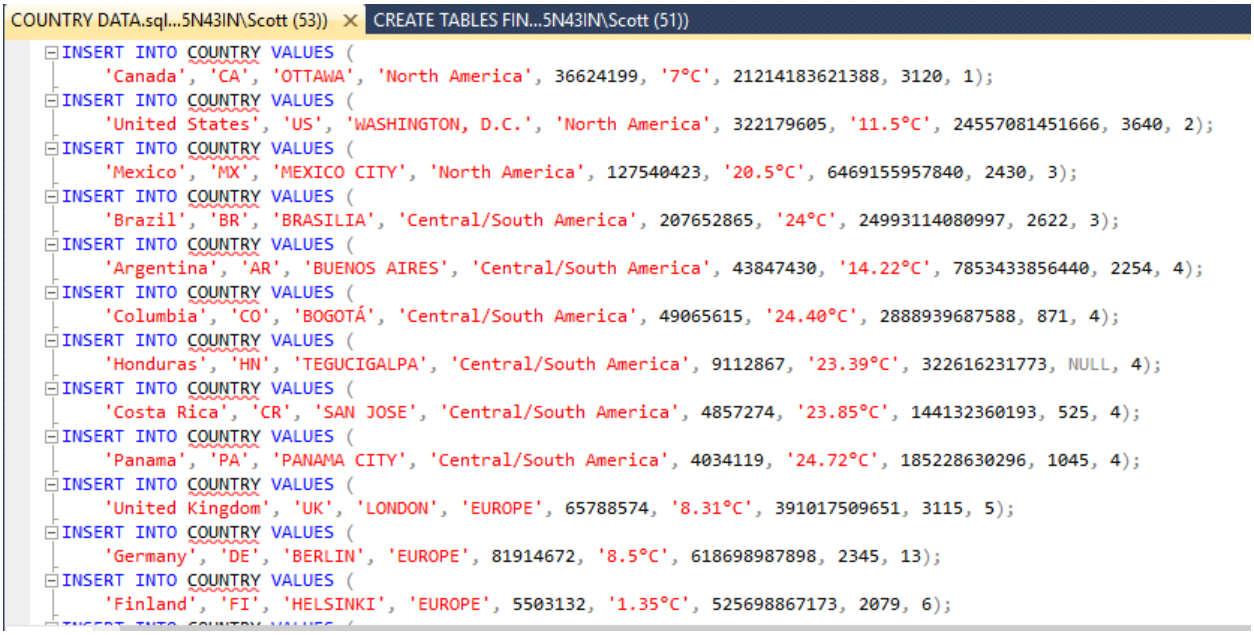
[6] Wikipedia, s.v. "List of countries by national capitals and largest cities," https://en.wikipedia.org/wiki/List_of_countries_by_national_capital_and_largest_cities (accessed December 4, 2017).
[7] Malhotra.
[8] Wikipedia, s.v. "List of countries by population," https://en.wikipedia.org/wiki/List_of_countries_by_population_(United_Nations) (accessed December 4, 2017).
[9] World Bank, s.v. "Climate Change Knowledge Portal: Historical Data," https://data.worldbank.org/data-catalog/cckp_historical_data (accessed December 14, 2017).
[10] Worlddata, https: www.worlddata.info (accessed December 14, 2017).
[11] World Bank.
[12] Nationmaster, s.v. "Energy > Electric power consumption > KWh: Countries Compared," http://www.nationmaster.com/country-info/stats/Energy/Electric-power-consumption/KWh (accessed December 13, 2017).
[13] Hofstede, 87, 215.
[14] CIA, "The World Factbook," http://teacherlink.ed.usu.edu/tlresources/reference/factbook/fields/2128.html?countryName=French%20Polynesia&countryCode=fp&regionCode=au&#fp (accessed December 7, 2017).
[15] Index Mundi, "Factbook," http://www.indexmundi.com/factbook/ (accessed December 7, 2017).

- Health table data regarding average life expectancy and infant mortality rates was from CIA World Factbook and the World Health Organization, provided through Wikipedia.[16] [17]

SQL program statements showing data insert and verification database queries are displayed in the following screen captures:



[16] Wikipedia, s.v. "List of countries by life expectancy," https://en.wikipedia.org/wiki/List_of_countries_by_life_expectancy; also, WHO, "World Health Statistics," http://www.who.int/gho/publications/world_health_statistics/2016/Annex_B/en/ (accessed December 3, 2017).

[17] Wikipedia, s.v. "List of countries by infant mortality rate," https://en.wikipedia.org/wiki/List_of_countries_by_infant_mortality_rate; also, CIA, "The World Factbook," https://www.cia.gov/library/publications/the-world-factbook/fields/2091.html (accessed December 3, 2017).

COUNTRY DATA.sql...5N43IN\Scott (53)) | CREATE TABLES FIN...5N43IN\Scott (51))

```
INSERT INTO COUNTRY VALUES (
    'Romania', 'RO', 'BUCHAREST', 'EUROPE', 19778083, '8.81°C', 546457548005, NULL, 7);
INSERT INTO COUNTRY VALUES (
    'Slovenia', 'SI', 'LJUBLJANA', 'EUROPE', 2077862, '8.04°C', 41979984850, NULL, 6);
INSERT INTO COUNTRY VALUES (
    'Ireland', 'IE', 'DUBLIN', 'EUROPE', 4726078, '8.02°C', 110893424553, 1960, 6);
INSERT INTO COUNTRY VALUES (
    'China', 'CN', 'BEIJING', 'ASIA PACIFIC', 1403500365, '6.33°C', 27373606559603, 1700, 8);
INSERT INTO COUNTRY VALUES (
    'India', 'IN', 'NEW DELHI', 'ASIA PACIFIC', 1324171354, '23.95°C', 9877095200034, 3693, 13);
INSERT INTO COUNTRY VALUES (
    'Australia', 'AU', 'CANBERRA', 'ASIA PACIFIC', 24125848, '21.51°C', 25097791332610, 3240, 9);
INSERT INTO COUNTRY VALUES (
    'Indonesia', 'ID', 'JAKARTA', 'ASIA PACIFIC', 261115456, '25.72°C', 4967990841642, 1092, 4);
INSERT INTO COUNTRY VALUES (
    'Japan', 'JP', 'TOKYO', 'ASIA PACIFIC', 127748513, '10.36°C', 809152633513, 2484, 5);
INSERT INTO COUNTRY VALUES (
    'Philippines', 'PH', 'MANILA', 'ASIA PACIFIC', 103320222, '25.33°C', 792147408547, 3008, 4);
INSERT INTO COUNTRY VALUES (
    'Egypt', 'EG', 'CAIRO', 'MIDDLE EAST/NORTH AFRICA', 95688681, '22.12°C', 3688671548848, NULL, 4 );
INSERT INTO COUNTRY VALUES (
    'Iran', 'IR', 'TEHRAN', 'MIDDLE EAST/NORTH AFRICA', 80277428, '16.93°C', 5183911292041, 2378, 10);
INSERT INTO COUNTRY VALUES (
    'Pakistan', 'PK', 'ISLAMABAD', 'MIDDLE EAST/NORTH AFRICA', 193203476, '19.98°C', 3010691250234, 770, 13);
```

COUNTRY DATA.sql...5N43IN\Scott (53)) | CREATE TABLES FIN...5N43IN\Scott (51))

```
INSERT INTO COUNTRY VALUES (
    'Israel', 'IL', 'JERUSALEM, TEL AVIV', 'MIDDLE EAST/NORTH AFRICA', 8191828, '19.70°C', 74554897955, 702, 9);
INSERT INTO COUNTRY VALUES (
    'Algeria', 'DZ', 'ALGIERS', 'MIDDLE EAST/NORTH AFRICA', 40606052, '22.58°C', 8162220322086, NULL, 4);
INSERT INTO COUNTRY VALUES (
    'United Arab Emirates', 'AE', 'ABU DHABI', 'MIDDLE EAST/NORTH AFRICA', 9269612, '26.83°C', 227379935005, 3040, 11);
INSERT INTO COUNTRY VALUES (
    'South Africa', 'ZA', 'BLOEMFONTEIN, CAPE TOWN, PRETORIA', 'SUB-SAHARAN AFRICA', 56015473, '17.60°C', 4204499011523, 3185, 6);
INSERT INTO COUNTRY VALUES (
    'Nigeria', 'NG', 'ABUJA', 'SUB-SAHARAN AFRICA', 185989640, '26.78°C', 2783723951089, 1540, 3);
INSERT INTO COUNTRY VALUES (
    'Kenya', 'KE', 'NAIROBI', 'SUB-SAHARAN AFRICA', 48461567, '24.50°C', 1857790042616, 1728, 4);
INSERT INTO COUNTRY VALUES (
    'Sudan', 'SD', 'KHARTOUM', 'SUB-SAHARAN AFRICA', 39578828, '26.82°C', 8702766346619, NULL, 4);
INSERT INTO COUNTRY VALUES (
    'Angola', 'AO', 'LUANDA', 'SUB-SAHARAN AFRICA', 28813463, '21.51°C', 3874754634369, NULL, 4);
INSERT INTO COUNTRY VALUES (
    'Chad', 'TD', 'N DJAMENA', 'SUB-SAHARAN AFRICA', 14452543, '26.65°C', 3874754634369, NULL, 4);
INSERT INTO COUNTRY VALUES (
    'Russia', 'RU', 'MOSCOW', 'RUSSIAN GROUP', 143964513, '-5.10°C', 30586340906705, NULL, 14);
INSERT INTO COUNTRY VALUES (
    'Estonia', 'EE', 'TALLINN', 'RUSSIAN GROUP', 1312442, '5.10°C', 79148788910, NULL, 6);
INSERT INTO COUNTRY VALUES (
    'Belarus', 'BY', 'MINSK', 'RUSSIAN GROUP', 9480042, '6.15°C', 379989767439, NULL, 12);
```

100 %

COUNTRY DATA.sql...5N43IN\Scott (53)) | CREATE TABLES FIN...5N43IN\Scott (51))

```
INSERT INTO COUNTRY VALUES (
    'Azerbaijan', 'AZ', 'BAKU', 'RUSSIAN GROUP', 9725376, '11.95°C', 406543853945, NULL, 4);
INSERT INTO COUNTRY VALUES (
    'Armenia', 'AM', 'YEREVAN', 'RUSSIAN GROUP', 2924816, '7.15°C', 74269254933, NULL, 9);
```

goverment data.sql...95N43IN\Scott (51))

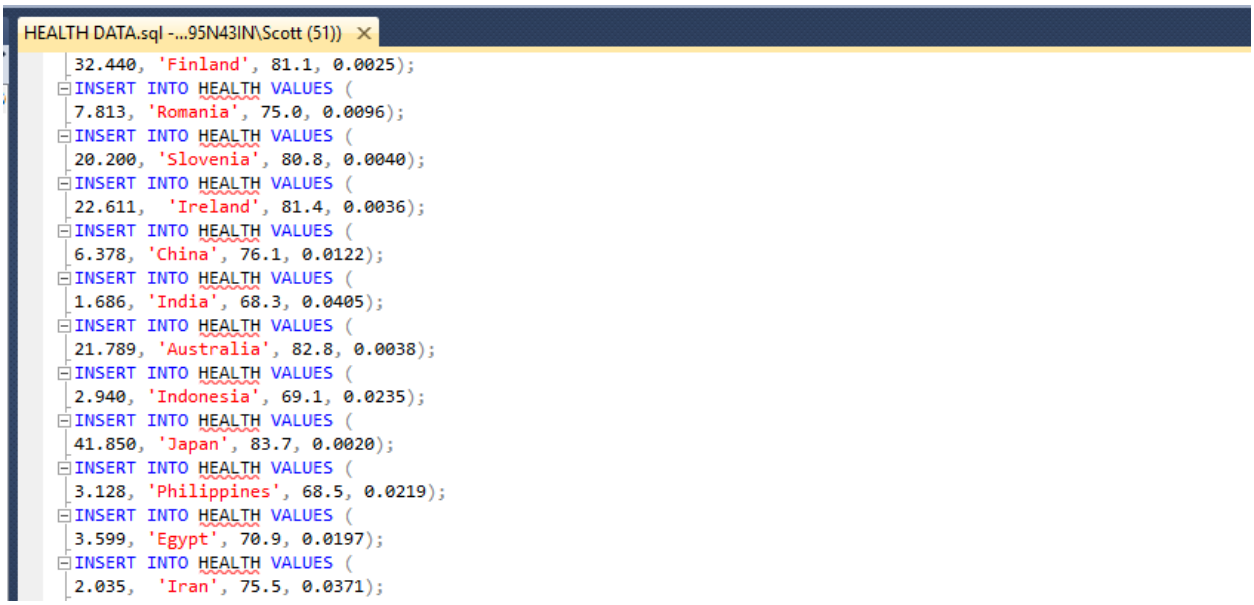
```
INSERT INTO GOVERNMENT VALUES (
1, 'Federal Parliamentary Democracy');
INSERT INTO GOVERNMENT VALUES (
2, 'Constitutional Federal Republic');
INSERT INTO GOVERNMENT VALUES (
3, 'Federal Presidential Republic');
INSERT INTO GOVERNMENT VALUES (
4, 'Presidential Republic');
INSERT INTO GOVERNMENT VALUES (
5, 'Parliamentary Constitutional Monarchy');
INSERT INTO GOVERNMENT VALUES (
6, 'Parliamentary Republic');
INSERT INTO GOVERNMENT VALUES (
7, 'Semi-Presidential Republic');
INSERT INTO GOVERNMENT VALUES (
8, 'Communist State');
INSERT INTO GOVERNMENT VALUES (
9, 'Parliamentary Democracy');
INSERT INTO GOVERNMENT VALUES (
10, 'Theocratic Republic');
INSERT INTO GOVERNMENT VALUES (
11, 'Federation of Monarchies');
INSERT INTO GOVERNMENT VALUES (
12, 'Dictatorship');
```

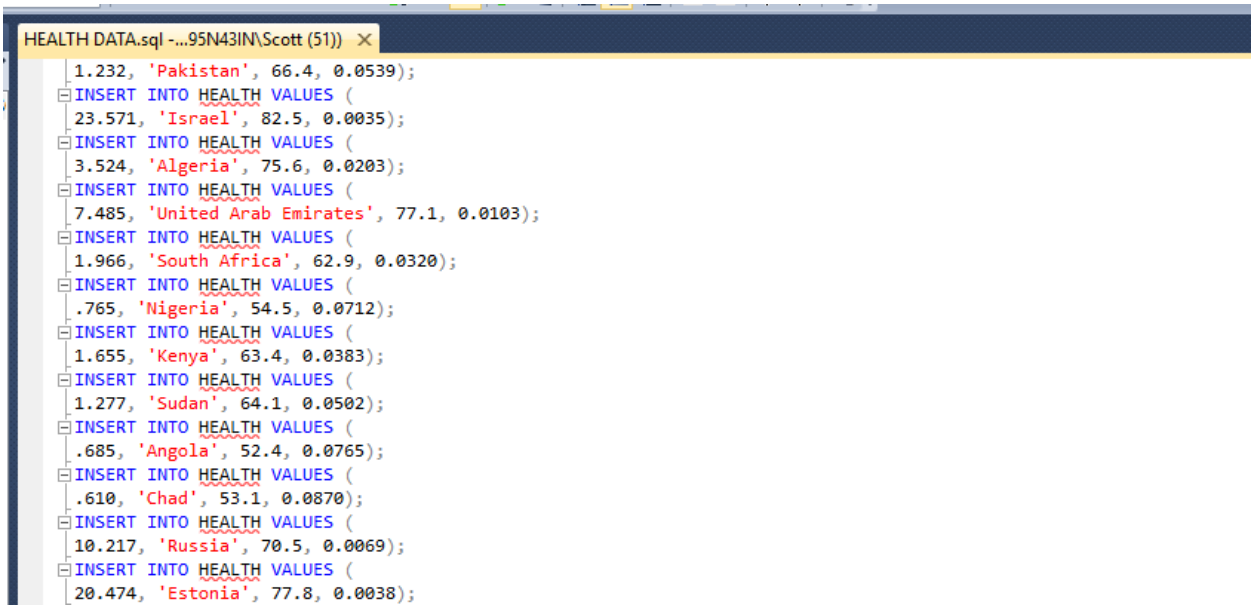
goverment data.sql...95N43IN\Scott (51))

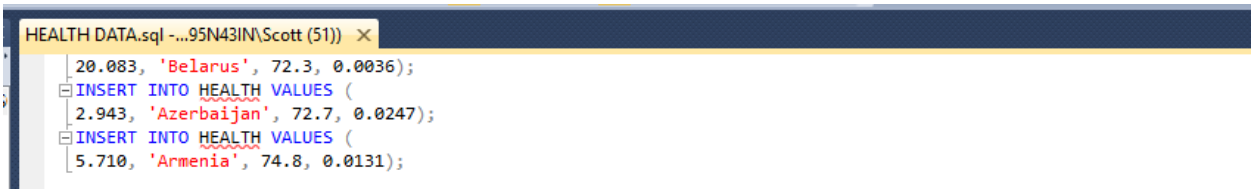
```
INSERT INTO GOVERNMENT VALUES (
13, 'Federal Parliamentary Republic');
INSERT INTO GOVERNMENT VALUES (
14, 'Semi-Presidential Federation');
```

HEALTH DATA.sql -...95N43IN\Scott (51))

```
INSERT INTO HEALTH VALUES (
17.870, 'Canada', 82.2, 0.0046 );
INSERT INTO HEALTH VALUES (
13.672, 'United States', 79.3, 0.0058);
INSERT INTO HEALTH VALUES (
6.445, 'Mexico', 76.7, 0.0119);
INSERT INTO HEALTH VALUES (
5.859, 'Brazil', 75.0, 0.0128 );
INSERT INTO HEALTH VALUES (
7.554, 'Argentina', 76.3, 0.0101);
INSERT INTO HEALTH VALUES (
5.020, 'Columbia', 74.8, 0.0149);
INSERT INTO HEALTH VALUES (
4.215, 'Honduras', 74.6, 0.0177);
INSERT INTO HEALTH VALUES (
9.590, 'Costa Rica', 79.6, 0.0083);
INSERT INTO HEALTH VALUES (
7.703, 'Panama', 77.8, 0.0101);
INSERT INTO HEALTH VALUES (
19.333, 'United Kingdom', 81.2, 0.0042);
INSERT INTO HEALTH VALUES (
21.892, 'Germany',81.0, 0.0037 );
```


HEALTH DATA.sql -...95N43IN\Scott (51))
32.440, 'Finland', 81.1, 0.0025);
INSERT INTO HEALTH VALUES (
7.813, 'Romania', 75.0, 0.0096);
INSERT INTO HEALTH VALUES (
20.200, 'Slovenia', 80.8, 0.0040);
INSERT INTO HEALTH VALUES (
22.611, 'Ireland', 81.4, 0.0036);
INSERT INTO HEALTH VALUES (
6.378, 'China', 76.1, 0.0122);
INSERT INTO HEALTH VALUES (
1.686, 'India', 68.3, 0.0405);
INSERT INTO HEALTH VALUES (
21.789, 'Australia', 82.8, 0.0038);
INSERT INTO HEALTH VALUES (
2.940, 'Indonesia', 69.1, 0.0235);
INSERT INTO HEALTH VALUES (
41.850, 'Japan', 83.7, 0.0020);
INSERT INTO HEALTH VALUES (
3.128, 'Philippines', 68.5, 0.0219);
INSERT INTO HEALTH VALUES (
3.599, 'Egypt', 70.9, 0.0197);
INSERT INTO HEALTH VALUES (
2.035, 'Iran', 75.5, 0.0371);


HEALTH DATA.sql -...95N43IN\Scott (51))
1.232, 'Pakistan', 66.4, 0.0539);
INSERT INTO HEALTH VALUES (
23.571, 'Israel', 82.5, 0.0035);
INSERT INTO HEALTH VALUES (
3.524, 'Algeria', 75.6, 0.0203);
INSERT INTO HEALTH VALUES (
7.485, 'United Arab Emirates', 77.1, 0.0103);
INSERT INTO HEALTH VALUES (
1.966, 'South Africa', 62.9, 0.0320);
INSERT INTO HEALTH VALUES (
.765, 'Nigeria', 54.5, 0.0712);
INSERT INTO HEALTH VALUES (
1.655, 'Kenya', 63.4, 0.0383);
INSERT INTO HEALTH VALUES (
1.277, 'Sudan', 64.1, 0.0502);
INSERT INTO HEALTH VALUES (
.685, 'Angola', 52.4, 0.0765);
INSERT INTO HEALTH VALUES (
.610, 'Chad', 53.1, 0.0870);
INSERT INTO HEALTH VALUES (
10.217, 'Russia', 70.5, 0.0069);
INSERT INTO HEALTH VALUES (
20.474, 'Estonia', 77.8, 0.0038);


HEALTH DATA.sql -...95N43IN\Scott (51))
20.083, 'Belarus', 72.3, 0.0036);
INSERT INTO HEALTH VALUES (
2.943, 'Azerbaijan', 72.7, 0.0247);
INSERT INTO HEALTH VALUES (
5.710, 'Armenia', 74.8, 0.0131);

pwr data.sql - DESK...95N43IN\Scott (51))

```
INSERT INTO PWR_GENERATION VALUES (
7, 'Canada',25.7, 10, 55.8, 8.3, 0.2);
INSERT INTO PWR_GENERATION VALUES (
2, 'United States', 73.5, 9.6, 7.4, 7.4, 2.1);
INSERT INTO PWR_GENERATION VALUES (
10, 'Mexico', 74.2, 2.1, 19, 4.7, 0);
INSERT INTO PWR_GENERATION VALUES (
8, 'Brazil', 18.7, 1.5,69.3, 10.5, 0);
INSERT INTO PWR_GENERATION VALUES (
16, 'Argentina', 68.1, 2.7, 26, 4, 2.8);
INSERT INTO PWR_GENERATION VALUES (
23, 'Columbia', 28.4, 0.0, 68.5, 3.1, 0);
INSERT INTO PWR_GENERATION VALUES (
34, 'Honduras', 60.9, NULL, 26.2, 11.4, 2.7);
INSERT INTO PWR_GENERATION VALUES (
29, 'Costa Rica', 30.7, NULL, 55.9, 13.3, .1);
INSERT INTO PWR_GENERATION VALUES (
31, 'Panama', 38.7, NULL, 61.3, NULL, NULL);
INSERT INTO PWR_GENERATION VALUES (
9, 'United Kingdom', 71.1, 11.7, 5.1, 12.2, NULL);
INSERT INTO PWR_GENERATION VALUES (
6, 'Germany', 43.2, 6.3, 5.1, 41.6, 3.8);
INSERT INTO PWR_GENERATION VALUES (
17, 'Finland', 51.6, 16.2, 18.9, 13.3, NULL);
```

pwr data.sql - DESK...95N43IN\Scott (51))

```
INSERT INTO PWR_GENERATION VALUES (
22, 'Romania', 44.3, 6.1, 30.0, 19.6, NULL);
INSERT INTO PWR_GENERATION VALUES (
28, 'Slovenia', 31.8, 34.4, 31.9, 1.7, .2);
INSERT INTO PWR_GENERATION VALUES (
1, 'China', 64, 2, 20.2, 13.7, .1);
INSERT INTO PWR_GENERATION VALUES (
5, 'India', 69.3, 1.9, 26.2, 11.4, NULL);
INSERT INTO PWR_GENERATION VALUES (
11, 'Australia', 78.5, NULL, 12.7, 7.6, 1.2);
INSERT INTO PWR_GENERATION VALUES (
14, 'Indonesia', 83.2, NULL, 11, 5.8, NULL);
INSERT INTO PWR_GENERATION VALUES (
3, 'Japan', 64.4, 15.1, 7.6, 3.8, 9.1);
INSERT INTO PWR_GENERATION VALUES (
20, 'Philippines', 50.7, NULL, 20.8, 11.4, .1);
INSERT INTO PWR_GENERATION VALUES (
15, 'Egypt', 87.7, NULL, 9.5, 2.8, NULL);
INSERT INTO PWR_GENERATION VALUES (
13, 'Iran', 85.6, 1.2, 12.4, .8, NULL);
INSERT INTO PWR_GENERATION VALUES (
19, 'Pakistan', 67.7, 3.2, 28.6, .4, .1);
INSERT INTO PWR_GENERATION VALUES (
21, 'Israel', 97.4, NULL, NULL, 2.6, NULL);
```

pwr data.sql - DESK...95N43IN\Scott (51))

```
INSERT INTO PWR_GENERATION VALUES (
24, 'Algeria', 98, NULL, 1.8, .2, NULL);
INSERT INTO PWR_GENERATION VALUES (
18, 'United Arab Emirates', 99.8, NULL, NULL, .2, NULL);
INSERT INTO PWR_GENERATION VALUES (
12, 'South Africa', 90.4, 4.4, 4.5, .7, NULL);
INSERT INTO PWR_GENERATION VALUES (
26, 'Nigeria',  83.5, NULL, 15, 1.5, NULL);
INSERT INTO PWR_GENERATION VALUES (
33, 'Kenya', 42.2, NULL, 43.9, 13.8, NULL);
INSERT INTO PWR_GENERATION VALUES (
32, 'Sudan', 30.7, NULL, 66.3, 3, NULL);
INSERT INTO PWR_GENERATION VALUES (
36, 'Angola', 50.3, NULL, 49.7, NULL, NULL);
INSERT INTO PWR_GENERATION VALUES (
37, 'Chad', 100, NULL, NULL, NULL, NULL);
INSERT INTO PWR_GENERATION VALUES (
4, 'Russia',25.7, 10, 55.8, 8.3, 0.2);
INSERT INTO PWR_GENERATION VALUES (
30, 'Estonia', 73.5, 9.6, 7.4, 7.4, 2.1);
INSERT INTO PWR_GENERATION VALUES (
25, 'Belarus', 74.2, 2.1, 19, 4.7, NULL);
INSERT INTO PWR_GENERATION VALUES (
27, 'Azerbaijan', 18.7, 1.5,69.3, 10.5, NULL);
```

pwr data.sql - DESK...95N43IN\Scott (51))

```
INSERT INTO PWR_GENERATION VALUES (
35, 'Armenia', 68.1, 2.7, 26, 4, 2.8);
```

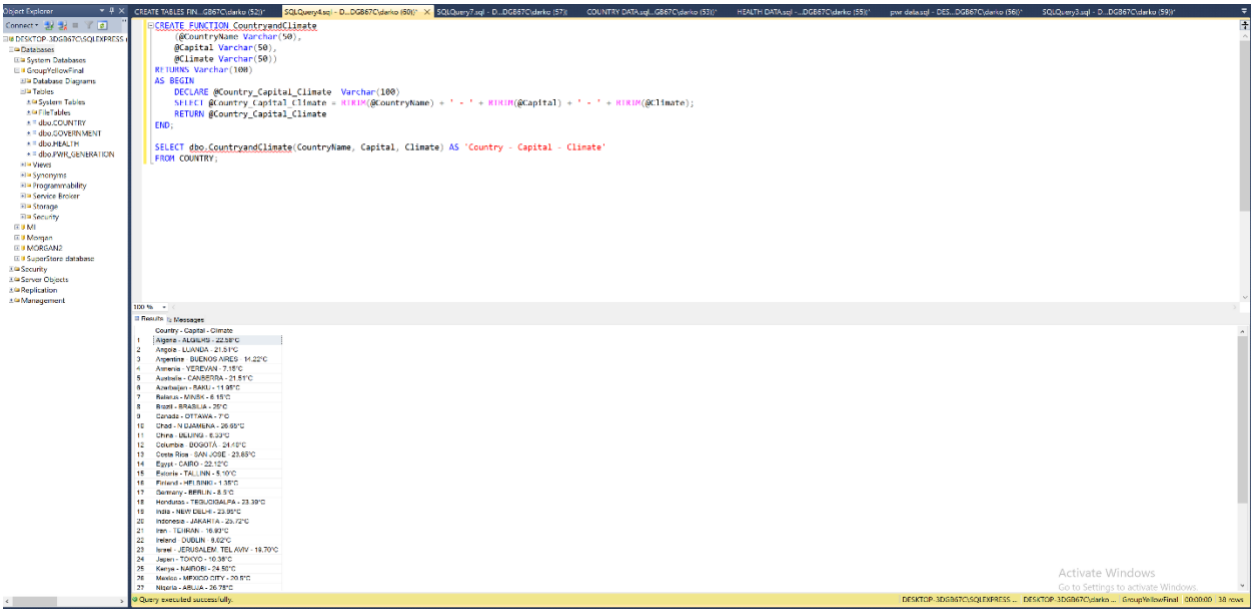
SQLQuery7.sql - DE...95N43IN\Scott (51))

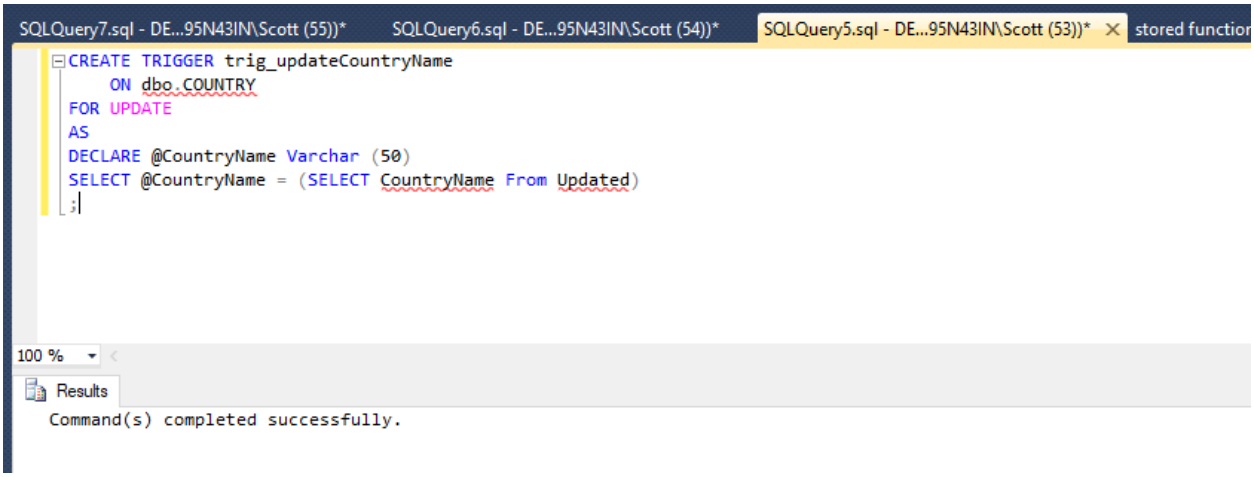
```
SELECT *
FROM GOVERNMENT;

SELECT *
FROM COUNTRY;

SELECT *
FROM HEALTH;

SELECT *
FROM PWR_GENERATION;
```

Once tables were loaded and verified, Yellow Team created a stored function that associated CountryName with Capital and Climate (average annual temperature) data, and a trigger on the Country table to update CountryName:

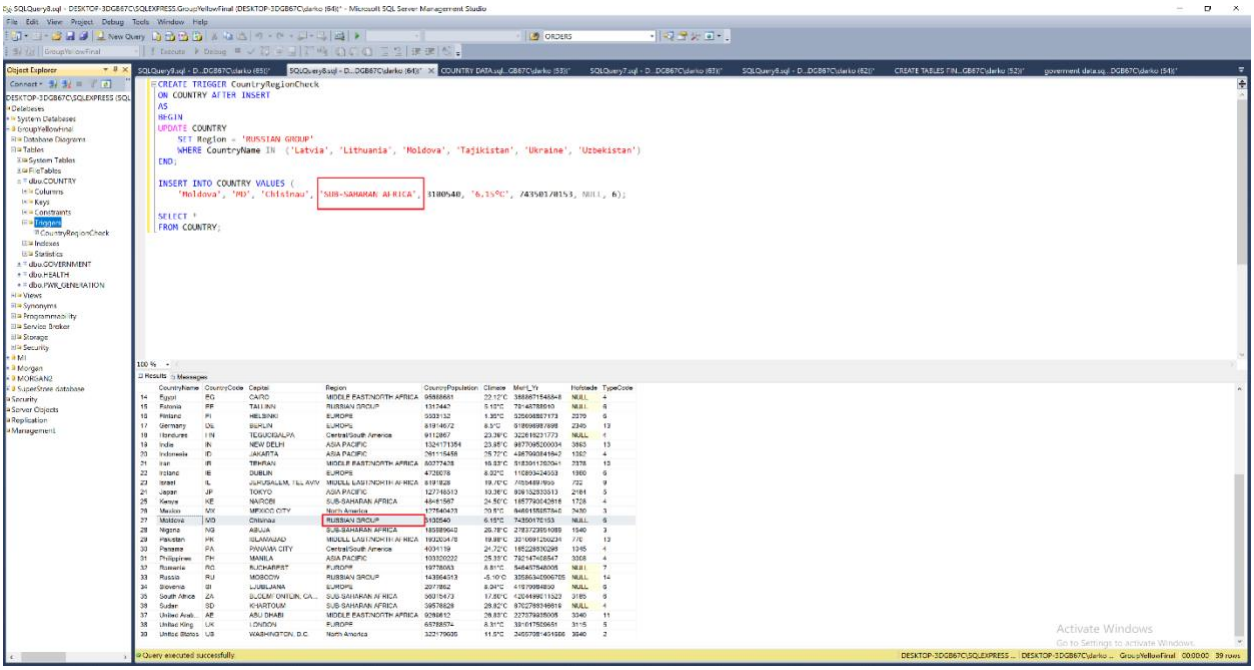
stored function.sql...95N43IN\Scott (51)) | SQLQuery7.sql - not connected

```
CREATE FUNCTION CountryandClimate
    (@CountryName Varchar(50),
    @Capital Varchar(50),
    @Climate Varchar(50))
RETURNS Varchar(100)
AS BEGIN
    DECLARE @Country_Capital_Climate  Varchar(100)
    SELECT @Country_Capital_Climate = RTRIM(@CountryName) + ' - ' + RTRIM(@Capital) + ' - ' + RTRIM(@Climate);
    RETURN @Country_Capital_Climate
END;

SELECT dbo.CountryandClimate(CountryName, Capital, Climate) AS 'Country - Capital - Climate'
FROM COUNTRY;
```

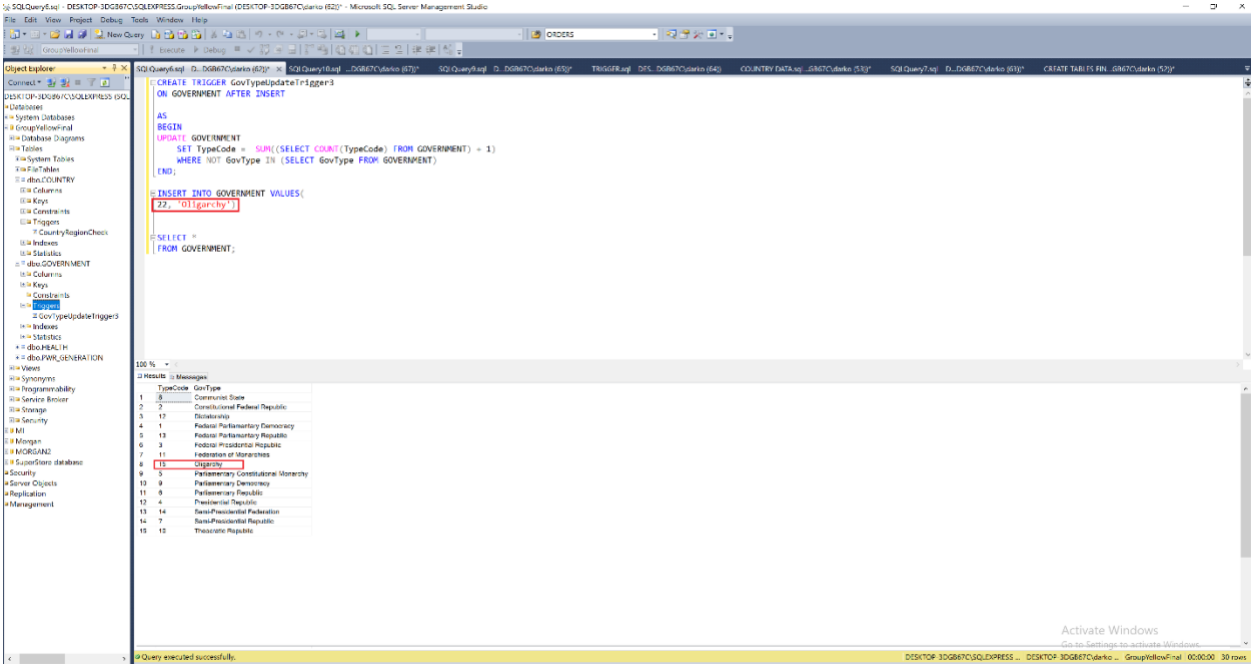




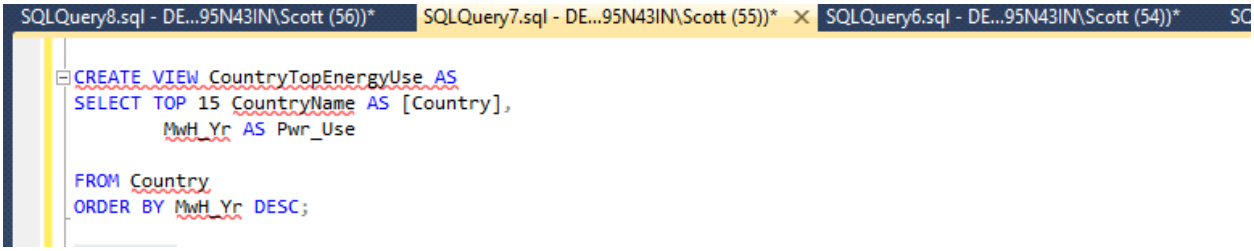
We developed additional triggers, on the assumption that in a future study, we would expand the number of countries in our data base—perhaps to as include all 193 UN member states. In the event that new countries were to be added to our database, one concern would be to ensure that each country was properly associated in the Country table with the correct region. The following trigger, specific here to the Russia Group of countries, could serve as a model. When a country in the Russia Group is inserted into the database, if an incorrect region is assigned, the trigger automatically corrects the entry to assign the country to the Russia Group:



Another trigger was prepared that was attached to the Government table. The trigger was conceived so that on inserting a new GovType, the trigger would automatically correct the entered TypeCode so that the insert was assigned the next TypeCode in the counting sequence, irrespective of what code was entered by a user.



Analysis for our report began by our creating a view and query on the top 15 countries in terms of energy use, followed by a view and query of the bottom 15 energy-using countries. Again, Yellow Team considered energy use as a proxy for economic development; however, the results did not correlate as well as expected with economic status. Comparing the query results with a list of the "Group of Eight" or "G-8" industrialized nations (Canada, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States), we discovered that Russia, the US, and Canada appeared in our top 15 energy-user query; G-8 members Germany, UK, and Japan did not rank in the query. The fast-emerging BRICS countries (Brazil, Russia, India, China, and South Africa) all appeared in the to 15 energy-user query, suggesting that energy use by country may be related more to rate of development than to gross economic output. For instance, G-8 members Germany and United Kingdom both were in the bottom 15 energy-users.[18]



[18] Council of Foreign Relations, s.v. "The Group of Eight Industrialized Nations," https://www.cfr.org/backgrounder/group-eight-g8-industrialized-nations (accessed December 16, 2017).

```
SELECT *
FROM CountryTopEnergyUse;
```

100 %

Results | Messages

	Country	Pwr_Use
1	Russia	30586340906705
2	China	27373606559603
3	Australia	25097791332610
4	Brazil	24993114080997
5	United States	24557081451666
6	Canada	21214183621388
7	India	9877095200034
8	Sudan	8702766346619
9	Algeria	8162220322086
10	Argentina	7853433856440
11	Mexico	6469155957840
12	Iran	5183911292041
13	Indonesia	4967990841642
14	South Africa	4204499011523
15	Angola	3874754634369

SQLQuery8.sql - DE...95N43IN\Scott (56))* | SQLQuery7.sql - DE...95N43IN\Scott (55))* | SQLQuery6.sql - DE...95N43IN\Scott (54))*

```
SELECT TOP 15 CountryName AS [Country],
       MwH_Yr AS Pwr_Use

FROM Country
ORDER BY MwH_Yr ASC;
```

```
SELECT *
FROM CountryLowestEnergyUse;
```

100 %

Results | Messages

	Country	Pwr_Use
1	Slovenia	41979984850
2	Armenia	74269254933
3	Israel	74554897955
4	Estonia	79148788910
5	Ireland	110893424...
6	Costa Rica	144132360...
7	Panama	185228630...
8	United Arab Emirates	227379935...
9	Honduras	322616231...
10	Belarus	379989767...
11	United Kingdom	391017509...
12	Azerbaijan	406543853...
13	Finland	525698867...
14	Romania	546457548...
15	Germany	618698987...

Using composite HealthIndex values as a second proxy for economic development, Yellow Team ranked the top 15 and bottom 15 countries. All six of the G-8 countries included in our database were ranked among the top 15 HealthIndex countries, indicating a potentially strong relationship between population health and economic development. Russia, from the BRICS group, appeared among the top 15 in terms of population health; however, India and South Africa were among the lowest ranked in population health. (China and Brazil received middling ranks and were not in the two HeathIndex queries.)

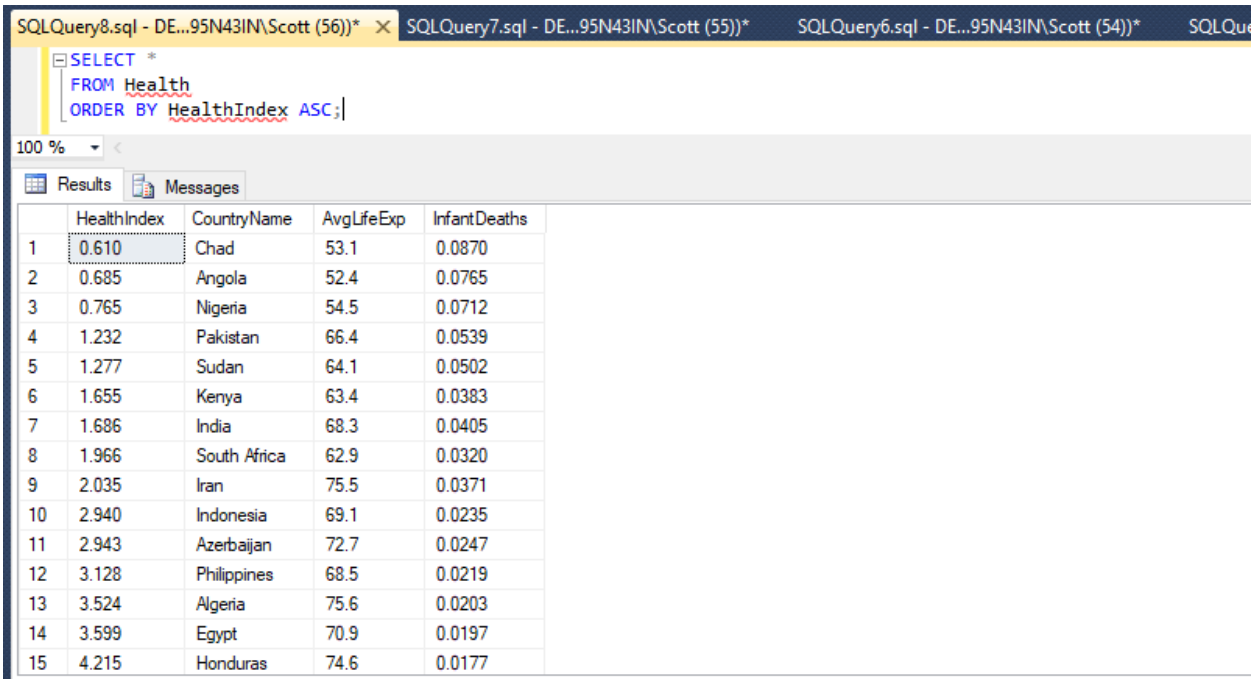
SQLQuery8.sql - DE...95N43IN\Scott (56))* | SQLQuery7.sql - DE...95N43IN\Scott (55))* | SQLQuery6.sql - DE...95N43IN\Scott (54))* | SQLQu

```
SELECT *
FROM Health
ORDER BY HealthIndex DESC;
```

100 %

Results | Messages

	HealthIndex	CountryName	AvgLifeExp	InfantDeaths
1	41.850	Japan	83.7	0.0020
2	32.440	Finland	81.1	0.0025
3	23.571	Israel	82.5	0.0035
4	22.611	Ireland	81.4	0.0036
5	21.892	Germany	81.0	0.0037
6	21.789	Australia	82.8	0.0038
7	20.474	Estonia	77.8	0.0038
8	20.200	Slovenia	80.8	0.0040
9	20.083	Belarus	72.3	0.0036
10	19.333	United Kingdom	81.2	0.0042
11	17.870	Canada	82.2	0.0046
12	13.672	United States	79.3	0.0058
13	10.217	Russia	70.5	0.0069
14	9.590	Costa Rica	79.6	0.0083
15	7.813	Romania	75.0	0.0096



	HealthIndex	CountryName	AvgLifeExp	InfantDeaths
1	0.610	Chad	53.1	0.0870
2	0.685	Angola	52.4	0.0765
3	0.765	Nigeria	54.5	0.0712
4	1.232	Pakistan	66.4	0.0539
5	1.277	Sudan	64.1	0.0502
6	1.655	Kenya	63.4	0.0383
7	1.686	India	68.3	0.0405
8	1.966	South Africa	62.9	0.0320
9	2.035	Iran	75.5	0.0371
10	2.940	Indonesia	69.1	0.0235
11	2.943	Azerbaijan	72.7	0.0247
12	3.128	Philippines	68.5	0.0219
13	3.524	Algeria	75.6	0.0203
14	3.599	Egypt	70.9	0.0197
15	4.215	Honduras	74.6	0.0177

Yellow Team programmed a JOIN between our Government and Country tables to query the relationship between type of government and annual energy usage. We created a query that, in descending order, ranked power users. Interestingly, ten of the top 15 energy-use nations are governed by either forms of government described as strongly centralized or authoritarian. Indeed, type of government—authoritarian versus liberal—appears from our cursory study to be strongly linked to a country's energy usage.

```
SELECT *
FROM Government JOIN Country
    ON Government.TypeCode = Country.TypeCode
ORDER BY Country.MwH_Yr DESC, Government.GovType;
```

100 %

Results | Messages

	TypeCode	GovType	CountryName	CountryCode	Capital	Region	CountryPopulation	Climate	MwH_Yr
1	14	Semi-Presidential Federation	Russia	RU	MOSCOW	RUSSIAN GROUP	143964513	-5.10°C	30586340906705
2	8	Communist State	China	CN	BEIJING	ASIA PACIFIC	1403500365	6.33°C	27373606559603
3	9	Parliamentary Democracy	Australia	AU	CANBERRA	ASIA PACIFIC	24125848	21.51°C	25097791332610
4	3	Federal Presidential Republic	Brazil	BR	BRASILIA	Central/South America	207652865	24°C	24993114080997
5	2	Constitutional Federal Republic	United States	US	WASHINGTON, D.C.	North America	322179605	11.5°C	24557081451666
6	1	Federal Parliamentary Democracy	Canada	CA	OTTAWA	North America	36624199	7°C	21214183621388
7	13	Federal Parliamentary Republic	India	IN	NEW DELHI	ASIA PACIFIC	1324171354	23.95°C	9877095200034
8	4	Presidential Republic	Sudan	SD	KHARTOUM	SUB-SAHARAN AFRICA	39578828	26.82°C	8702766346619
9	4	Presidential Republic	Algeria	DZ	ALGIERS	MIDDLE EAST/NORTH AFRICA	40606052	22.58°C	8162220322086
10	4	Presidential Republic	Argentina	AR	BUENOS AIRES	Central/South America	43847430	14.22°C	7853433856440
11	3	Federal Presidential Republic	Mexico	MX	MEXICO CITY	North America	127540423	20.5°C	6469155957840
12	10	Theocratic Republic	Iran	IR	TEHRAN	MIDDLE EAST/NORTH AFRICA	80277428	16.93°C	5183911292041
13	4	Presidential Republic	Indonesia	ID	JAKARTA	ASIA PACIFIC	261115456	25.72°C	4967990841642
14	6	Parliamentary Republic	South Africa	ZA	BLOEMFONTEIN, ...	SUB-SAHARAN AFRICA	56015473	17.60°C	4204499011523
15	4	Presidential Republic	Angola	AO	LUANDA	SUB-SAHARAN AFRICA	28813463	21.51°C	3874754634369
16	4	Presidential Republic	Chad	TD	N DJAMENA	SUB-SAHARAN AFRICA	14452543	26.65°C	3874754634369
17	4	Presidential Republic	Egypt	EG	CAIRO	MIDDLE EAST/NORTH AFRICA	95688681	22.12°C	3688671548848
18	13	Federal Parliamentary Republic	Pakistan	PK	ISLAMABAD	MIDDLE EAST/NORTH AFRICA	193203476	19.98°C	3010691250234
19	4	Presidential Republic	Columbia	CO	BOGOTÁ	Central/South America	49065615	24.40°C	2888939687588
20	3	Federal Presidential Republic	Nigeria	NG	ABUJA	SUB-SAHARAN AFRICA	185989640	26.78°C	2783723951089
21	4	Presidential Republic	Kenya	KE	NAIROBI	SUB-SAHARAN AFRICA	48461567	24.50°C	1857790042616
22	5	Parliamentary Constitutional Mo	Japan	JP	TOKYO	ASIA PACIFIC	127748513	10.36°C	809152633513

Finally, Yellow Team wanted to create a view and query that tested the antithesis to Dr. Malhotra's argument that economic development rather than population growth was the primary driver of energy consumption. We created a PopulationEnergyView that compared energy use to a rank ordering of countries by population, and discovered that seven of the top 10 most populous nations were listed among the top energy-use countries. Without performing a statistical inquiry, we were left to wonder if population or population growth was not the strongest indicator for energy demand.

SQLQuery8.sql - DE...95N43IN\Scott (56))* | SQLQuery7.sql - DE...95N43IN\Scott (55))* | SQLQuery6.sql - DE...95N43IN\Scott (54))* | SQL

```
CREATE VIEW PopulationEnergyView AS
SELECT  TOP 15 CountryName AS [Country],
        MwH_Yr AS Pwr_Use,
        CountryPopulation AS [Population]
FROM Country
ORDER BY CountryPopulation DESC;
```

```
SELECT *
FROM PopulationEnergyView;
```

100 %

Results | Messages

	Country	Pwr_Use	Population
1	China	27373606559603	1403500365
2	India	9877095200034	1324171354
3	United States	24557081451666	322179605
4	Indonesia	4967990841642	261115456
5	Brazil	24993114080997	207652865
6	Pakistan	3010691250234	193203476
7	Nigeria	2783723951089	185989640
8	Russia	30586340906705	143964513
9	Japan	809152633513	127748513
10	Mexico	6469155957840	127540423
11	Philippines	792147408547	103320222
12	Egypt	3688671548848	95688681
13	Germany	618698987898	81914672
14	Iran	5183911292041	80277428
15	United King...	391017509651	65788574

```
SELECT *
FROM CountryTopEnergyUse;
```

100 %

Results | Messages

	Country	Pwr_Use
1	Russia	30586340906705
2	China	27373606559603
3	Australia	25097791332610
4	Brazil	24993114080997
5	United States	24557081451666
6	Canada	21214183621388
7	India	9877095200034
8	Sudan	8702766346619
9	Algeria	8162220322086
10	Argentina	7853433856440
11	Mexico	6469155957840
12	Iran	5183911292041
13	Indonesia	4967990841642
14	South Africa	4204499011523
15	Angola	3874754634369

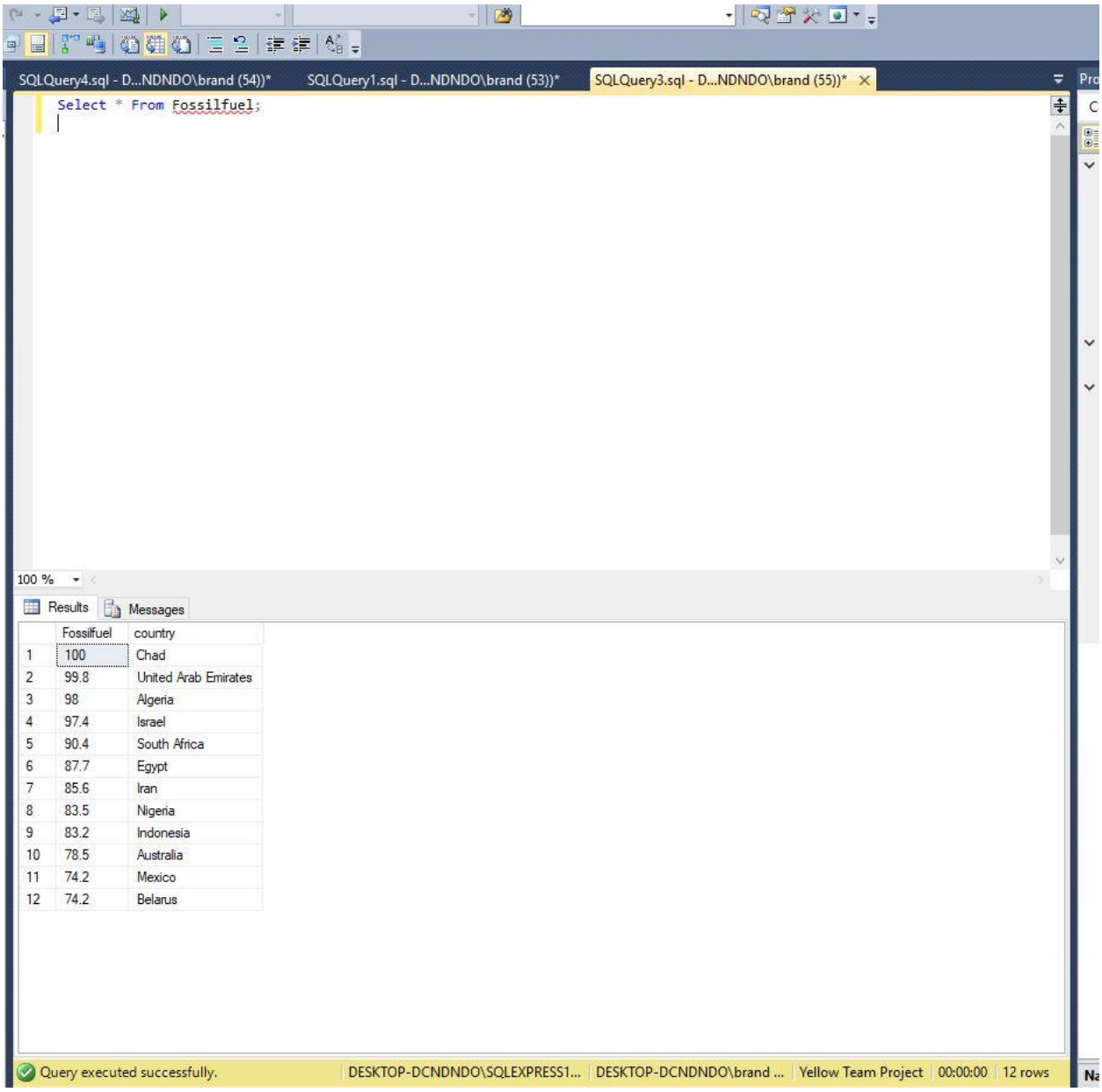
IV. Conclusion

Yellow Team questioned the hypothesis of Dr. Malhotra and SRI International's research team that regional energy consumption is primarily a function of affluence, not population. To model relationships between countries' energy usage and economic status in a study of necessarily limited scope, our team, sought proxies for complex factors such as population health and economic development.

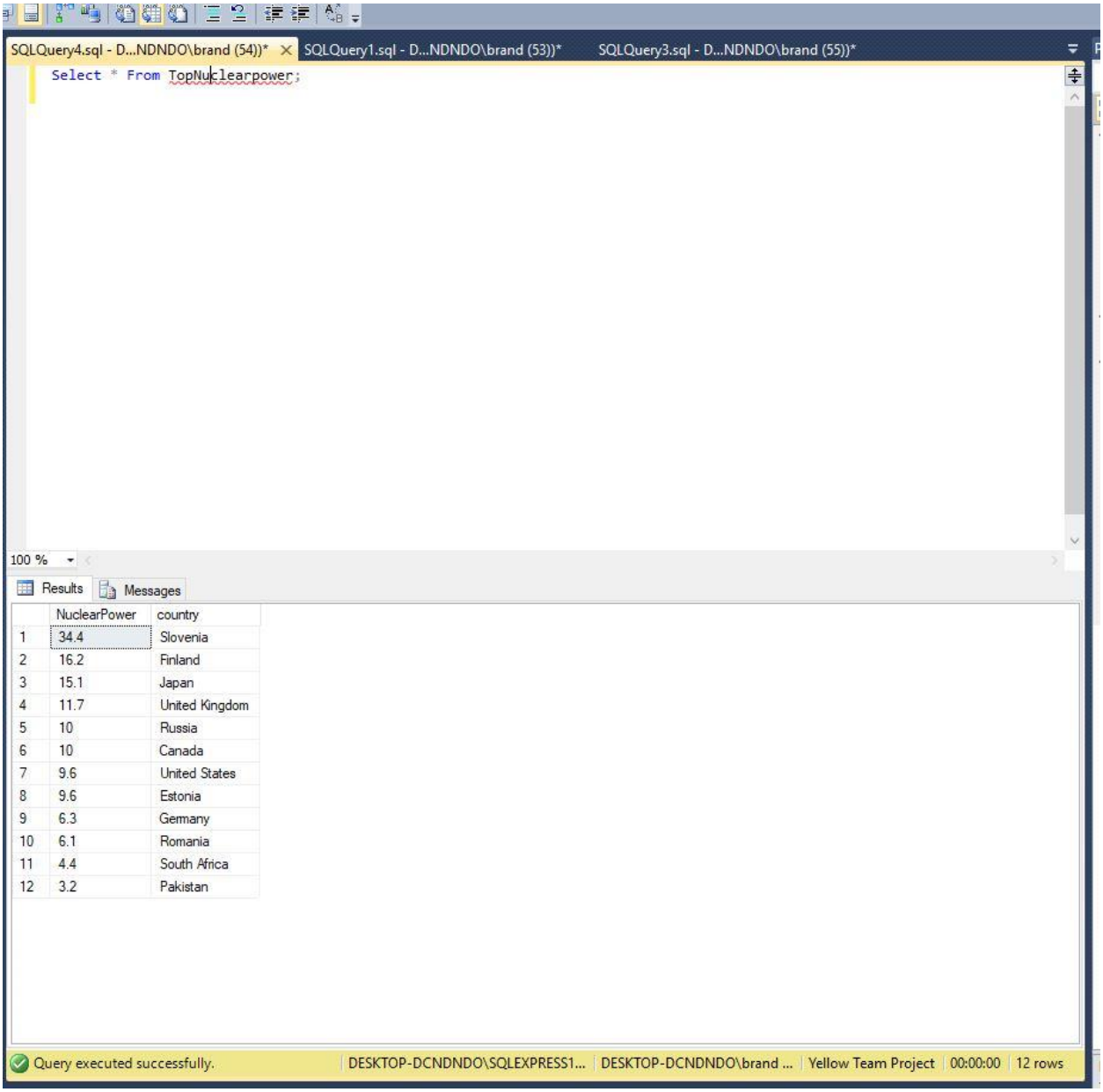
The "HealthIndex" proxy our team synthesized from two of the most commonly accepted population health indicators—average life expectancy and infant mortality rate—gave a relative ordering by country that corresponded fairly well with popular notions regarding countries' economic well-being. Japan, for instance, with the world's longest average life expectancy and one of the lowest rates for infant mortality, scored a very high 418.50 on our index scale. Chad, one of the poorest countries, scored 6.10—the lowest from among our selected countries. Our conclusion was that the HealthIndex performed well as a proxy for population health, and was a fair indicator of national economic status. One could argue that our scale did not accurately represent the absolute differences between countries, and that some of the resultant relative ordering was debatable. (Was Japan with a 418.50 actually better off in economic terms than Canada or the United States with scores of 178.7 and 136.72, respectively?) Nevertheless, at the regional level, we found HealthIndex scores to be a simple and acceptable proxy.

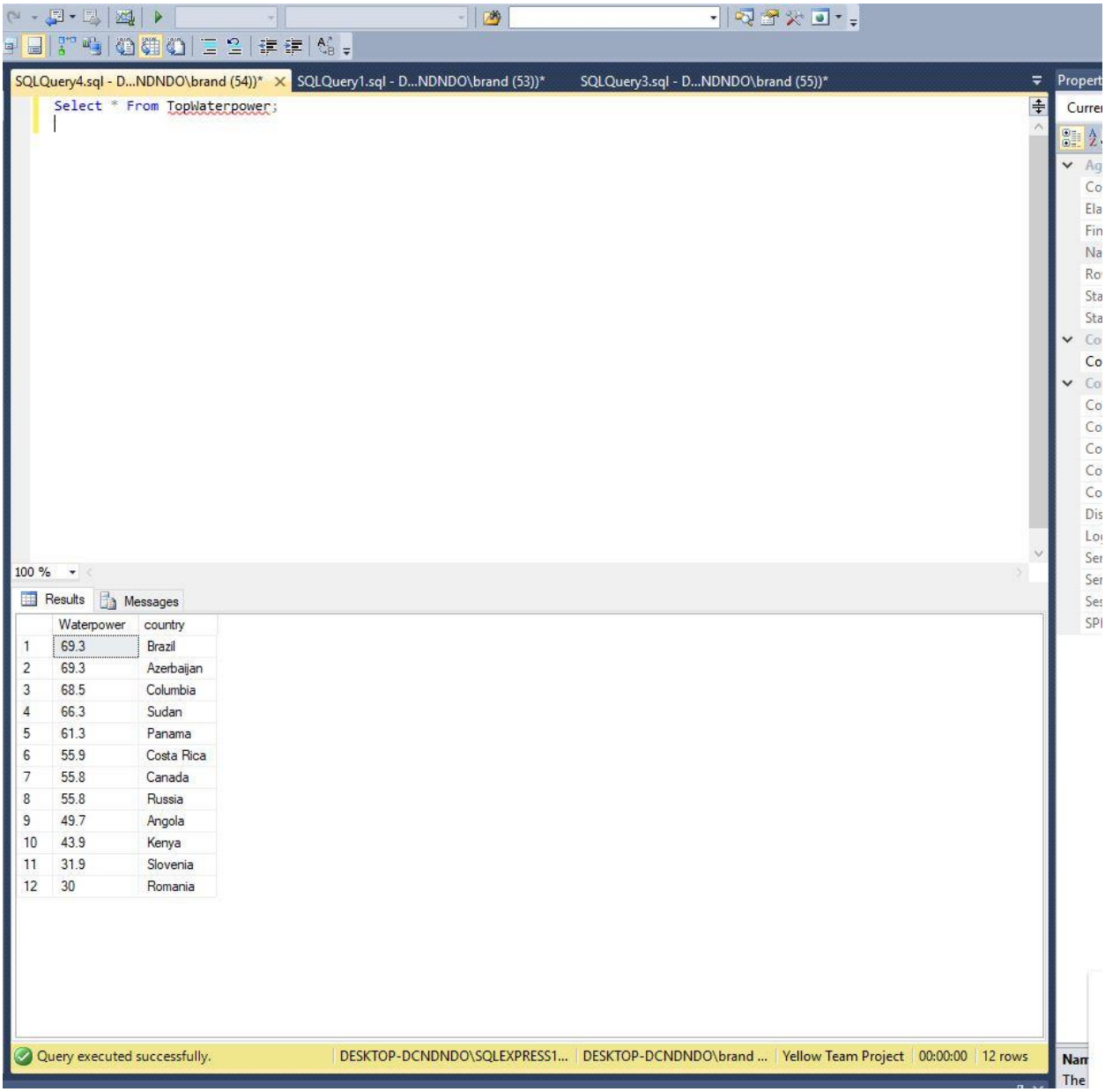
Yellow Team also used a by-country ranking of power consumption as our EnergyRank index. This index served as another proxy for economic status. While gathering data, we considered the percentage of contribution to a country's overall energy mix on the assumption that advanced economies with increased demand for energy would be more likely to possess the technology and public will to develop multiple sources of energy, rather than be reliant on only one or two main sources. Developing countries, we presumed, would be more closely tied to traditional hydrocarbon fuel, while developed countries were likely to have increased the proportion of alternative or "renewable" energy sources in their overall energy mix. Middle-ranked economies might take advantage of hydroelectric and nuclear technology, which require a large capital expenditure—beyond the means of many poor nations. Poorer nations, we

reasoned, would have fewer energy options, while wealthier countries would show the greatest power diversity.



	Fossilfuel	country
1	100	Chad
2	99.8	United Arab Emirates
3	98	Algeria
4	97.4	Israel
5	90.4	South Africa
6	87.7	Egypt
7	85.6	Iran
8	83.5	Nigeria
9	83.2	Indonesia
10	78.5	Australia
11	74.2	Mexico
12	74.2	Belarus


SQLQuery4.sql - D...NDNDO\brand (54))*
SQLQuery1.sql - D...NDNDO\brand (53))*
SQLQuery3.sql - D...NDNDO\brand (55))*
Select * From TopNuclearpower;
100 %
Results
Messages
NuclearPower country
1 34.4 Slovenia
2 16.2 Finland
3 15.1 Japan
4 11.7 United Kingdom
5 10 Russia
6 10 Canada
7 9.6 United States
8 9.6 Estonia
9 6.3 Germany
10 6.1 Romania
11 4.4 South Africa
12 3.2 Pakistan
Query executed successfully.
DESKTOP-DCNDNDO\SQLEXPRESS1...
DESKTOP-DCNDNDO\brand ...
Yellow Team Project
00:00:00
12 rows



	Waterpower	country
1	69.3	Brazil
2	69.3	Azerbaijan
3	68.5	Columbia
4	66.3	Sudan
5	61.3	Panama
6	55.9	Costa Rica
7	55.8	Canada
8	55.8	Russia
9	49.7	Angola
10	43.9	Kenya
11	31.9	Slovenia
12	30	Romania

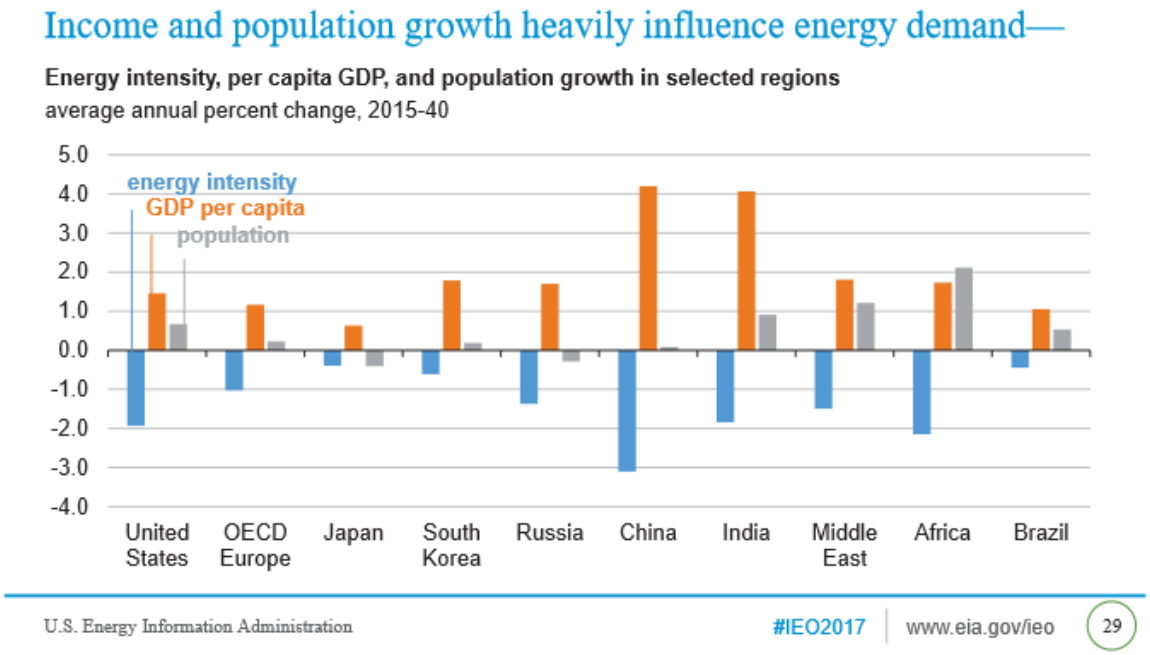
This line of reasoning was interesting, but was ultimately left out from our creating DBMS views, as we believed that EnergyRank alone was sufficient to organize our queries. Yellow Team concluded that more in-depth research could be done in the future using discrete data on the major energy sources: oil, coal, natural gas, hydroelectric, nuclear, solar, wind, geothermal, and biomass. A separate study regarding countries' economic ranking and energy diversity may reveal more proof for Dr. Malhotra's argument that it is economic prosperity rather than population growth that is the primary driver for increased energy demand.

A third index Yellow Team created, the Hofstede, did not perform satisfactorily as a proxy for economic development. At the extremes, developed countries such as Canada, US, UK, and Australia—the "Anglosphere"—ranked highest; Columbia, Costa Rica, and Pakistan ranked at the bottom, which was to be expected. UAE and South Africa scored almost as highly as Canada and the UK, which surprised us given the level of wealth and income inequality in those nations. Israel, arguably an economically advanced nation, scored lower than either Nigeria or Kenya; India ranked above the United States, which caused our team to question the value of using only two out of Hofstede's original five cultural factors as elements in a synthetic index. We rejected our own Hofstede index, not because we questioned the original IBM data, but because we doubted our own ability to interpret and manipulate parts from that data to provide a meaningful proxy for either national or regional economic status.

A major surprise came from our finding that a country's having a highly centralized or authoritarian form of government appears to be a factor in the country's consuming a relatively large amount of energy. As we stated in our assumptions, energy efficiency was not taken into consideration in this study. It could be that illiberal governments encourage wasteful energy practices; however, such a determination would require further research. Also, in our assumptions we indicated that energy production and energy consumption were made equivalents in our study. From our data sources, we know this is not actually the case for most countries; however, for the purpose of our work, we believed that our relying on energy consumption data would suffice with respect to validating the Malhotra/SRI International hypothesis.

What resulted from our investigation into relationships between country, population health, energy production, and government type data was an agreement that *both* economic development and population growth significantly influence energy demand. This is the position taken by the US Energy Information Agency.[19] We agree with that position.

[19] US EIA, "International Energy Outlook 2017," https://www.eia.gov/outlooks/ieo/pdf/0484(2017).pdf (accessed December 13, 2017).



Source: US EIA