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## **Description of the data**

For this project, we decided to work with data from the U.S Energy Information Administration (<http://www.eia.gov/beta/international/>), focusing on international energy consumption and production. The initial data set we found included all the countries and its consumption, production, population, and CO2 emissions data from 1980 to 2013. Because there was a lot of missing information from years prior to 1993 and we wanted users to be able to fully capture what was happening around the globe, we decided to filter the data such that we only showed countries that existed from 1993 and onwards. We chose to focus on consumption as our main map, while portraying comparison data with production for top three and user selected countries in our bar graph.

Our second dataset also comes from the EIA, but is different as it shows the breakdown of energy consumption and production for each country. The datasets included specific variables of Petroleum, Natural Gas, Coal, and Electricity consumption and production in terms of Quadrillion BTU for each country from 1993-2013. The data is visualized through our chord diagram. To correctly filter and format the data, the CSVs for Petroleum, Natural Gas, Coal, and Electricity consumption were initially downloaded. Each were then filtered for China's, Russia's, and USA's consumption in each sector for the 20 years. After the remaining countries were summed to calculate the total consumption in each sector for all other countries. The data collected data was then set as a matrix, where rows defined an energy source and columns represented country (hence, the (x,y) cell of the matrix represents country x's consumption in resource y). The data was then scaled so that the consumption of a specific resource was comparable amongst the countries. As chord diagrams are implemented as a two-way mapping, the matrix was then extended so that the rows and columns were first the listed resources and then the countries in opposite order. The matrix was then transposed diagonally and an additional row and column were added in order to stretch out the chord diagram. This was then done for all twenty years. Then, this process was repeated for production of each resource.

**A description of the mapping from data to visual elements. Describe the scales you used, such as position, color, or shape. Mention any transformations you performed, such as log scales. (10 pts)**

Our visualization is broken down into three parts. The first part is the main map, which shows the international energy consumption data with a mercator projection. We use a slider to access the changes in years and show this through a color gradient. For the map, we also have a hover which shows the exact numbers of energy consumption in quadrillion BTU.

Our second graph is a bullet bar chart that compares consumption data with production data. We decided a bullet chart is the best way to combine the data without cluttering the graph with too many bars, and we chose blue and grey to keep consistent with our theme. The blue bar represents the consumption data while the overlay grey bar represents the production data. After looking at our data from the map, we thought it'd be best to display the top three countries and allow users to select up to three countries for comparison, mainly to show how much more the top three both consume and produce. The bar chart also works in accordance with the slider to show changes over the years.

Our third graph is a chord diagram that breaks up the energy consumption and production of the top three countries in comparison to the rest of the world. The chord diagram is used to show the ratios, as well as the change over time when we use the slider. We scaled all the 4 energy sections into equal components and order the ratios in descending order. By hovering over the labels or the arc, we can highlight the selected areas and fade out the rest.

### **The story. What does your visualization tell us? What was surprising about it? (5 pts)**

It was our priority to make sure using three graphs would not provide three different visualizations. Instead, we combined the graphs in a way that produced one concrete and thorough visualization. It starts off by showing an overview of the overall change in energy consumption around the globe from 1993 to 2013. We then wanted to zoom in on the top three countries to show their changes and growth of both consumption compared to production, and at the same time allow users to make comparisons with other countries they want to zoom in on. Lastly we look at the energy breakdown of the top three countries to see what is driving the growth.

From looking at our visualization, we can see that the top three countries are mainly the ones that grow in both consumption and production over the two decades. When focusing in and looking on the bar chart, we also see that the US energy growth has been relatively slow in production and consumption, while China has managed to grow incredibly fast and eventually surpassing us. We also see energy growth in the OPEC countries as well, and notice that it's mainly driven by production rather than consumption as we zoom in on the data. When looking at the breakdown of the top 3, we see that China energy growth is mainly driven by coal, whereas US and Russia are more evenly split between all four categories.

Sources:

How developing countries proj to consume most energy:

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Russia dec energy sector:

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Data source:

<http://www.eia.gov/beta/international/>

Coal facts:

<http://www.theguardian.com/environment/ng-interactive/2014/nov/10/interactive-how-the-world-uses-coal-us-china-carbon-deal>