

## Homework 1:

Yash Gokhale (Andrew ID: ysg)

### Energy Conversion and Supply (39610) Fall 2020

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#### 1. Resources and Reserves

##### a) Largest Coal Reserves in the world

1 tonne coal =  $2.93 \times 10^{10}$  joule equivalent<sup>1</sup>

Country	Reserve content
United States of America	250.2 billion tonnes <sup>2</sup> / 7331 exajoules
Russia	160.3 billion tonnes <sup>2</sup> / 4697 exajoules
Australia	147.4 billion tonnes <sup>2</sup> / 4319 exajoules

##### b) Largest Natural Gas Reserves in the world

1 MMcf natural gas =  $1.055 \times 10^{12}$  joules<sup>3</sup>

Country	Reserve content
Russia	1.68 billion MMcf <sup>4</sup> / 1772 exajoules
Iran	1.2 billion MMcf <sup>4</sup> / 1266 exajoules
Qatar	0.87 billion MMcf <sup>4</sup> / 917.85 exajoules

##### c) Largest oil reserves in the world<sup>5</sup>

Country	Reserve content
Venezuela	300 billion barrels
Saudi Arabia	269 billion barrels
Canada	171 billion barrels

##### d) Largest uranium reserves in the world

1 ton of Uranium-235 =  $7.4 \times 10^{16}$  joules<sup>6</sup>

Country	Reserve content
Kazakhstan	22808 tonnes <sup>7</sup> / 1688 exajoules
Canada	6938 tonnes <sup>7</sup> / 513 exajoules
Australia	6613 tonnes <sup>7</sup> / 489 exajoules

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<sup>1</sup> <https://www.convertunits.com/from/tonne+of+coal+equivalent/to/joule>

<sup>2</sup> <https://www.mining-technology.com/features/feature-the-worlds-biggest-coal-reserves-by-country/>

<sup>3</sup> <https://www.convertunits.com/from/tonne+of+coal+equivalent/to/joule>

<sup>4</sup> <https://www.worldometers.info/gas/gas-reserves-by-country/>

<sup>5</sup> <https://www.nsenenergybusiness.com/features/newstop-ten-countries-with-worlds-largest-oil-reserves-5793487/>

<sup>6</sup> <https://www.ocean.washington.edu/courses/envir215/energynumbers.pdf>

<sup>7</sup> <https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/world-uranium-mining-production.aspx>

## 2. Energy and Reserves

Country: **India**

### a. India's reserves

1 tonne coal =  $2.93 \times 10^{10}$  joule equivalent<sup>8</sup>

1 MMcf natural gas =  $1.055 \times 10^{12}$  joules<sup>9</sup>

1 Barrel Oil =  $6.12 \times 10^9$  joules<sup>10</sup>

1 ton of Uranium-235 =  $7.4 \times 10^{16}$  joules<sup>11</sup>

Energy Source	Reserve content
Coal	101.3 billion tonnes <sup>2</sup> /2968 exajoules
Natural Gas	0.05 billion MMcf <sup>12</sup> / 52.74 exajoules
Oil	4.72 billion barrels <sup>13</sup> / 28.88 exajoules
Uranium	308 tonnes <sup>7</sup> / 22.8 exajoules

Thus, India's reserves follow the following order in terms of energy:

1. Coal
2. Natural Gas
3. Oil
4. Uranium

### b. Ranking for India

Energy Source	Ranking
Coal	5 <sup>th</sup> [2]
Natural Gas	22 <sup>nd</sup> [12]
Oil	24 <sup>th</sup> [10]
Uranium	11 <sup>th</sup> [7]

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<sup>8</sup> <https://www.convertunits.com/from/tonne+of+coal+equivalent/to/joule>

<sup>9</sup> <https://www.convertunits.com/from/tonne+of+coal+equivalent/to/joule>

<sup>10</sup> <http://www.kylesconverter.com/energy,-work,-and-heat/barrels-of-oil-equivalent-to-joules>

<sup>11</sup> <https://www.ocean.washington.edu/courses/envir215/energynumbers.pdf>

<sup>12</sup> <https://www.worldometers.info/gas/india-natural-gas/>

<sup>13</sup> <https://www.worldometers.info/oil/india-oil/>

### 3. Current Events

Article link: <https://www.nytimes.com/2020/07/06/business/energy-environment/renewable-energy-natural-gas.html>

This article from NYC touches upon the most pertinent question right now: how would the battle for traditional energy sources and renewable energy sources would shape up. I am interested in renewable energy applications and I am curious as to how the technology shapes up over the next few years to closely understand whether a future with minimum fossil fuel energy sources is possible.

- a) The article talks about what percentage of the energy in USA is supplied by coal and other sources. It also talks about the cancellation of the Atlantic Coast Pipeline by Dominion and Duke Energy due to lack of energy supply and increase in the project cost.
- b) The article also throws light on the possibility of using batteries to cater to the growing energy demand. But, the commercialization of this technology is still hindered because of high costs and low storage capacity. It also mentions that in spite of increased renewable energy power plants, the corporations are hesitant to use them, and are instead focusing on converting coal fired power plants to natural gas fired power plants.