Energy consumption is related to many factors, but the variability of the industrial structure is relatively large. The industrial structure and its changes are the main factors affecting the energy consumption. Therefore, it is of great practical significance to analyze the relationship between industrial structure and energy consumption. Taken together, we choose the total consumption and industrial structure to measure the energy consumption in a region.

Our aim is to use the Energy profile to represent the total annual consumption of various energy sources and their structure. According to the official website of the data introduction and their own induction of energy. We divide energy into Coal, Natural Gas, Petroleum, Renewable Energy and Nuclear electric power.

1.1Energy classification

# Coal

coal = ['CL', 'CC']

|  |  |
| --- | --- |
| CL | Coal |
| CC | Coal coke |

# Natrual Gas

ng = ['NN']

|  |  |
| --- | --- |
| NG # | natural gas, including supplemental gaseous fuels |
| NN | natural gas, excluding supplemental gaseous fuels |

# Petroleum

petro=['AB','AR','AV','CO','DF','DK','FF','FN','FO','FS','JF','JK','KS','LG','LO','LU','MB','MG','MS','NA','P1','PC','PO','PP','PL','RF','SN','SG','US','WX','UO']

|  |  |
| --- | --- |
| AB | aviation gasoline blending components |
| AR | asphalt and road oil |
| AV | aviation gasoline |
| CO | crude oil, including lease condensate |
| DF | distillate fuel oil |
| DK # | distillate fuel oil, including kerosene-type jet fuel |
| FF | fossil fuels |
| FN | petrochemical feed stocks, naphtha less than 401˚F |
| FO | petrochemical feed stocks, other oils equal to or greater than 401˚F |
| FS | petrochemical feed stocks, still gas |
| JF | jet fuel |
| JK # | jet fuel, kerosene-type |
| KS | kerosene |
| LG | liquefied petroleum gases |
| LO | electrical system energy losses |
| LU | lubricants |
| MB | Motor gasoline blending components |
| MG | motor gasoline |
| MS | miscellaneous petroleum products |
| NA | natural gasoline (including isopentane) |
| P1 | asphalt and road oil, aviation gasoline, kerosene, lubricants, and other petroleum products |
| PC | petroleum coke |
| PO | other petroleum products |
| PP | pentanes plus |
| PL | plant condensate |
| RF | residual fuel oil |
| SN | Special naphthas |
| SG | still gas |
| US | unfractionated streams |
| UO | unfinished oils |
| WX | waxes |

# Renewable energy

re = ['EN','EM','ES','GE','GO','HY','SO','WY','WW','WD','BM']

|  |  |
| --- | --- |
| BM | biomass |
| EN | fuel ethanol, including denaturant |
| EM | fuel ethanol, excluding denaturant |
| ES | fuel ethanol, including denaturant |
| GE | geothermal energy |
| GO | geothermal and solar energy |
| HY | hydroelectric power |
| SO | photovoltaic and solar thermal energy |
| WY | wind |
| WW | wood and waste |
| WD | wood |

# Nuclear electric power

nu = ['NU']

|  |  |
| --- | --- |
| NU | nuclear electric power |

1.2 Introduce four kinds of departments

1) Residential sector

An energy-consuming sector that consists of living quarters for private households.

We choose to use RCB (residential energy consumption, data in British thermal units (Btu)) to measure its energy consumption.

2) Commercial sector

An energy-consuming sector that consists of service-providing facilities and equipment of: businesses; federal, state, and local governments; and other private and public organizations. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities.

We choose to use CCB (commercial energy consumption, data in British thermal units (Btu)) to measure its energy consumption.

3)Industrial sector

An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods.

We chose to use ICB (Industrial energy consumption, data in British thermal units (Btu)) to measure its energy consumption.

4) Transportation sector

An energy-consuming sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another.

We chose to use TCB(Transportation energy consumption, data in British thermal units (Btu)) to measure its energy consumption.

2. Explain the formula and explain the calculation process and reasons

2.1 Calculation of the total consumption of five types of energy

Filter out the annual consumption of all energy sources in each type of energy from the data and seek for accumulation.

For example, Coal: CL, CC. The total consumption of coal in 2009 is CLTCB + CCTCB.

Note the total consumption of five types of energy, respectively. Coal: coalTCB. Natural Gas: ngTCB. Petroleum: petroTCB. Renewable Energy: reTCB. Nuclear energy: nuTCB.

2.2 Calculate the consumption of five kinds of energy in four sectors separately

From the data, we choose the energy consumption of all energy sources in each sector and then add up according to the sector.

For example, Coal : CL, CC. Consumption of coal in the Residential sector in 2009 is: CLRCB + CCRCB; Consumption in the commercial sector is: CLCCB + CCCCB; Consumption in the Industrial sector is: CLICB + CCICB; Consumption in the Transportation sector is: CLACB + CLACB .

Note the total consumption of five types of energy, respectively. Coal: coalRCB, coalCCB, coalICB, coalACB. Natural Gas: ngRCB, ngCCB, ngICB, ngACB. Petroleum: petroRCB, petroCCB, petroICB, petroACB. Renewable Energy: reRCB, reCCB, reICB, reACB. Nuclear energy has no industrial structure and no data.

2.3 Formula for energy profile

Matrix form

EP=[coalTCB/TETCB, coalRCB/TERCB, coalCCB/TECCB, coalICB/TEICB, coalACB/TEACB; ngTCB/TETCB, ngRCB/TERCB, ngCCB/TECCB, ngICB/TEICB, ngACB/TEACB; petroTCB/TETCB, petroRCB/TERCB, petroCCB/TECCB, petroICB/TEICB, petroACB/TEACB; reTCB/TETCB, reRCB/TERCB, reCCB/TECCB, reICB/TEICB, reACB/TEACB;

nuTCB/TETCB]