Plugging into the Future: An Exploration of Electricity Consumption Patterns

PROJECT REPORT

1.INTRODUCTION

1.1. OVERVIEW

India is the world's third-largest producer and third-largest consumer of electricity. The national electric grid in India has an installed capacity of 370.106 GW as of 31 March 2020. Renewable power plants, which also include large hydroelectric plants, constitute 35.86% of India's total installed capacity. During the fiscal year (FY) 2019–20, the total electricity generation in the country was 1,598 TWh, of which 1,383.5 TWh generated by utilities. The gross electricity consumption per capita in FY2019 was 1,208 kWh. In 2015-16, electric energy consumption in agriculture was recorded as being the highest (17.89%) worldwide. The per capita electricity consumption is low compared to most other countries despite India having a low electricity tariff. In light of the recent COVID-19 situation, when everyone has been under lockdown for the months of March to June the impacts of the lockdown on economic activities have been faced by every sector in a positive or a negative way.

Energy has been universally recognized as one of the most important inputs for economic growth and human development. There is a strong two-way relationship between economic development and energy consumption. On one hand, growth of an economy, with its global competitiveness, hinges on the availability of cost-effective and environmentally benign energy sources, and on the other hand, the level of economic development has been observed to be dependent on the energy demand (EIA, 2006).The charts are created from the given datas and thus dashboards and stories are created using tableau.

1.2. PURPOSE

This project helps to identify the electricity consumption pattern in a easiest way from the highest to the lowest states in a graphical representation. This graphical representation will give a clear idea of how to control the usage of electricity in particular states by taking several measures.

2.PROBLEM DEFINITION & DESIGN THINKING
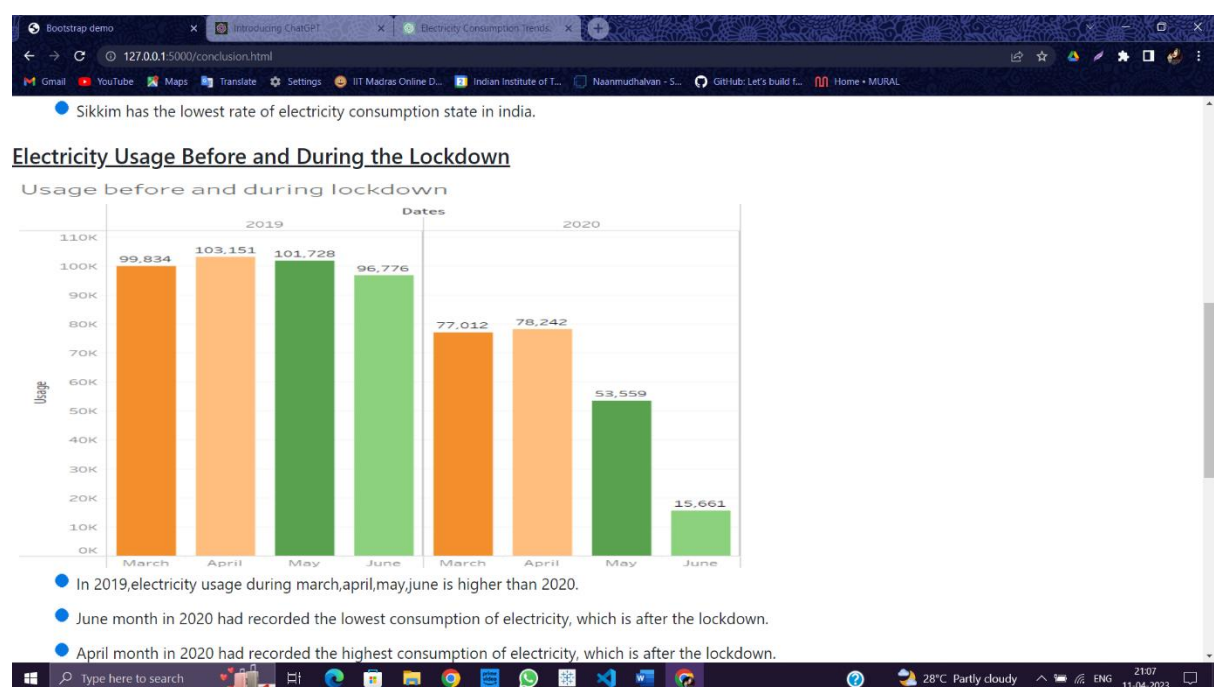
2.1.Empathy Map
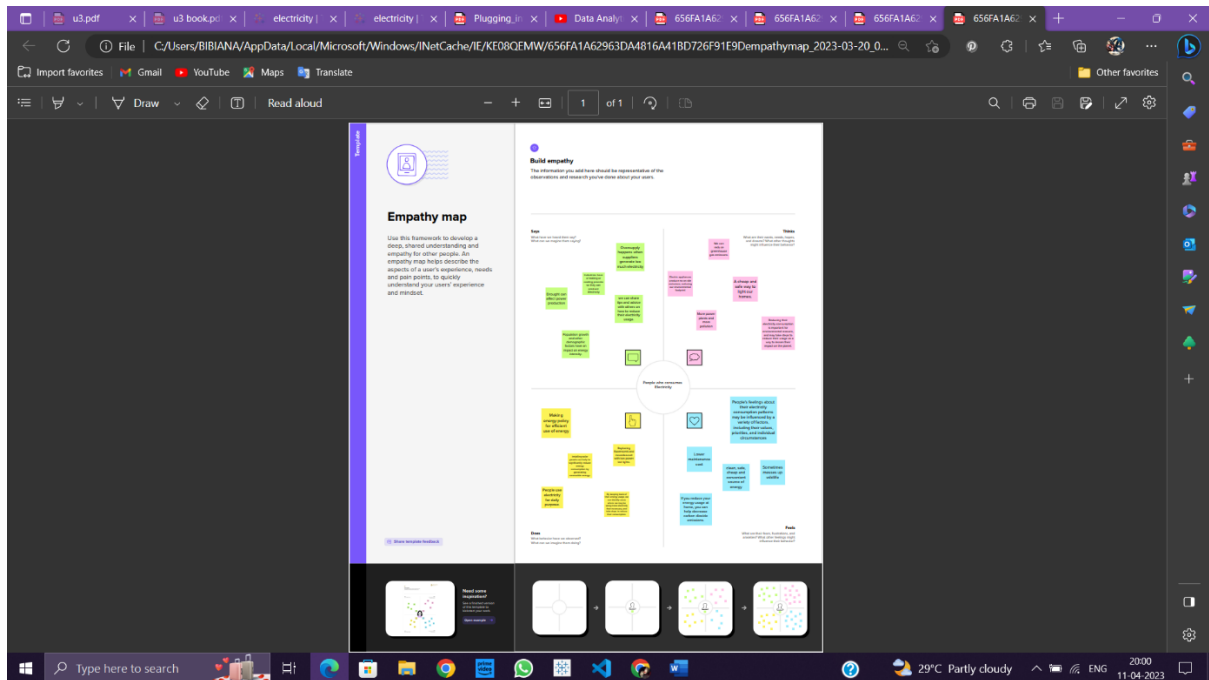
2.2.Ideation & Brainstroming map
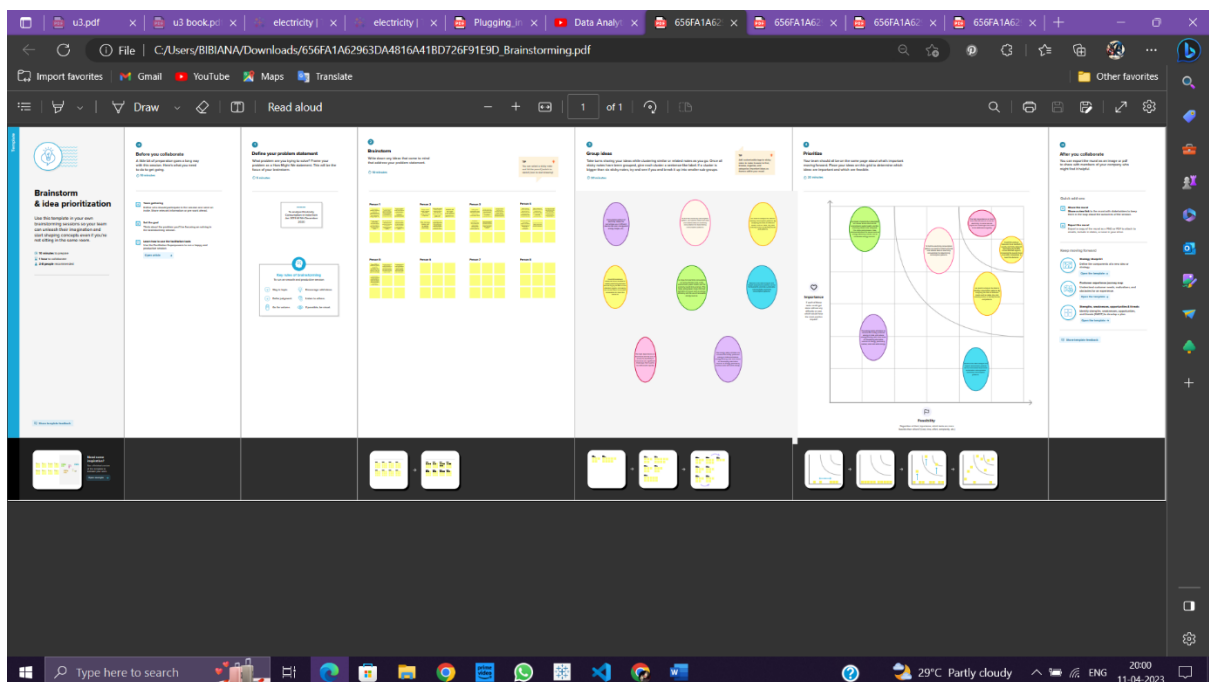
3.RESULT

The COVID-19 pandemic resulted in changes to electricity consumption patterns, with many people working from home and reducing their overall energy usage. However, this was offset by increased residential electricity consumption due to more people being at home,

as well as higher demand for electricity to power healthcare facilities and other critical infrastructure. Overall, the analysis of electricity consumption in 2020 would depend on a range of factors specific to individual regions and countries. However, it is likely that the COVID-19 pandemic, the increasing use of renewable energy, and the adoption of electric vehicles all played a role in shaping consumption patterns.

- In 2019, electricity usage during march, april, may, june is higher than 2020.
- June month in 2020 had recorded the lowest consumption of electricity, which is after the lockdown.
- April month in 2020 had recorded the highest consumption of electricity, which is after the lockdown.

4.ADVANTAGES & DISADVANTAGES

ADVANTAGES

- By providing access to electricity, the analysis can help to improve the quality of life for people living in areas without access to electricity, including providing access to lighting, heating, and cooling, and powering essential services such as hospitals and schools.
- By understanding consumption patterns and trends, the analysis can help businesses identify market opportunities and develop strategies to meet the growing demand for electricity in India.
- This information can be used to identify areas where consumption is high and areas where it is low. Identify opportunities for improving energy efficiency and reducing consumption in different sectors and regions.
- This information can be used to develop policies and programs to promote energy efficiency.
- This information can be used by government agencies, electricity providers, and investors to develop policies and make investment decisions that promote sustainable energy development and consumption in India.

DISADVANTAGES

- COVID-19 has caused great challenges to the energy industry. Potential new practices and social forms being facilitated by the pandemics created great impacts on energy demand and consumption.
- The months of January and February in 2020 had seen an increase of 3% and 7% in power supply, respectively as compared to 2019.

5.APPLICATIONS

There are several applications that make use of the analysis of electricity consumption data. Here are a few examples:

1. Energy Management: One of the most important applications of analyzing electricity consumption is to manage energy consumption. By analyzing electricity consumption data, businesses and households can identify areas where energy is being wasted and take steps to reduce their overall consumption. Energy management systems can also be used to automatically control and optimize energy usage based on usage patterns, occupancy, and other factors.

2. Billing and Metering: Analysis of electricity consumption data is also essential for accurate billing and metering. Electricity companies can use consumption data to calculate accurate bills and monitor usage patterns over time. This data can also be used to identify and investigate instances of fraud or tampering with meters.

3. Demand Response: Electricity consumption data can also be used to support demand response programs, where customers are incentivized to reduce their electricity usage during periods of high demand. By analyzing consumption data, energy providers can identify customers who are using a lot of energy during peak times and offer them incentives to reduce their usage.

4. Renewable Energy Integration: The analysis of electricity consumption data is also crucial for integrating renewable energy sources into the grid. As the production of renewable energy is intermittent, consumption data can be used to forecast demand and match it with the supply of renewable energy.

5. Predictive Maintenance: Finally, electricity consumption data can be used for predictive maintenance of electrical equipment. By analyzing consumption patterns and detecting anomalies, businesses can identify potential issues before they occur and take corrective action to prevent equipment failures and costly downtime.

Overall, the analysis of electricity consumption data is essential for effective energy management, billing, demand response, renewable energy integration, and predictive maintenance.

6.CONCLUSION

By analysing the datasets of electricity consumption, we have come to the conclusion that this informations can be used by government organnisations and private organization. By using this information businesses and households can identify areas where energy is being wasted and take steps to reduce their overall consumption, Which can help us to develop policies and programs to promote energy efficiency. By analyzing consumption patterns and detecting anomalies, businesses can identify potential issues before they occur and take corrective action to prevent equipment failures and costly downtime. The growing use of smart home technologies and the internet of things (IoT) is likely to increase demand for electricity as more devices become connected and require power. However, this trend also

presents opportunities to better manage and optimize electricity consumption through more efficient use of energy.

7.FUTURE SCOPE

The future scope of electricity consumption is likely to continue growing, driven by a variety of factors including population growth, urbanization, and the increasing adoption of electric vehicles, renewable energy sources, and smart home technologies.

One of the biggest drivers of future electricity consumption is likely to be the ongoing growth of global population and urbanization. As more people move into cities and countries become more developed, the demand for electricity to power homes, businesses, and industries will continue to rise.

Another key factor is the increasing adoption of electric vehicles, which are expected to become more affordable and widespread in the coming years. This will require significant investment in charging infrastructure, and will likely lead to increased demand for electricity.

In addition, the growing use of renewable energy sources such as solar and wind power is expected to continue, which will require significant investments in energy storage and grid infrastructure to ensure that the electricity generated can be distributed and used effectively.

Finally, the growing use of smart home technologies and the internet of things (IoT) is likely to increase demand for electricity as more devices become connected and require power. However, this trend also presents opportunities to better manage and optimize electricity consumption through more efficient use of energy.

Overall, the future scope of electricity consumption is likely to be shaped by a complex interplay of technological, economic, and social factors, and will require significant investment and innovation to ensure that energy needs are met sustainably and efficiently.

8.APPENDIX

A.Source Code

- **app.py**

```python
from flask import Flask,redirect,url_for,render_template
app=Flask(__name__)
@app.route('/')
def getmyweb():
    return render_template('index.html')
@app.route('/dashboard.html')
def dashboard():
    return render_template('dashboard.html')
@app.route('/story.html')
def story():
```

```python
    return render_template('story.html')
@app.route('/conclusion.html')
def conclusion():
    return render_template('conclusion.html')
```

- **index.html**

```html
<!doctype html>
<html lang="en">
  <head>
    <style>
      @import
url('https://fonts.googleapis.com/css2?family=Tilt+Prism&display
y=swap');
    </style>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-
scale=1">
    <title>Bootstrap demo</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/css/bootstrap.min.css" rel="stylesheet"
integrity="sha384-
KK94CHFLLe+nY2dmCWGMq91rCGa5gtU4mk92HdvYe+M/SXH301p5ILy+dN9+nJO
Z" crossorigin="anonymous">
  </head>
  <body>
    <nav class="navbar navbar-expand-lg navbar-dark bg-dark">
      <div class="container-fluid">


        <a class="navbar-brand"  href="#">Data Analytics using
Tableau</a>
        <button class="navbar-toggler" type="button" data-bs-
toggle="collapse" data-bs-target="#navbarColor01" aria-
controls="navbarColor01" aria-expanded="false" aria-
label="Toggle navigation">
          <span class="navbar-toggler-icon"></span>
        </button>
        <div class="collapse navbar-collapse"
id="navbarColor01">
```

```html
        <ul class="navbar-nav me-auto">
          <li class="nav-item">
            <a class="nav-link active" href="#">HOME
              <span class="visually-hidden">(current)</span>
            </a>
          </li>
          <li class="nav-item">
            <a class="nav-link"
href="dashboard.html">DASHBOARD</a>
          </li>
          <li class="nav-item">
            <a class="nav-link" href="story.html">STORY</a>
          </li>
          <li class="nav-item">
            <a class="nav-link"
href="conclusion.html">CONCLUSION</a>
          </li>

        </ul>

      </div>
    </div>
  </nav>
  </style>


    <center>
      <img src="https://bestpracticeenergy.com/wp-
content/uploads/2020/08/Electricity-Generation-Featured-
Image.jpg" alt="show image" height="400" width="400">
    </center>
  <h1 font-family: 'Tilt Prism'; align="center"><p
class="text-primary-emphasis"><u>Analysis of Electricity
Consumption Pattern in India</u></p></h1>
    <center>
      <p><font size="5">India is the world's third-largest
producer and third-largest consumer of electricity. Renewable
power plants, which also include large hydroelectric plants,
constitute
```

```
            35.86% of India's total installed capacity.The
gross electricity consumption per capita in FY2019 was 1,208
kWh.</font></p>
    </center>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/js/bootstrap.bundle.min.js" integrity="sha384-
ENjdO4Dr2bkBIFxQpeoTz1HIcje39Wm4jDKdf19U8gI4ddQ3GYNS7NTKfAdVQSZ
e" crossorigin="anonymous"></script>
  </body>
</html>
```

- **dashboard.html**

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-
scale=1">
    <title>Bootstrap demo</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/css/bootstrap.min.css" rel="stylesheet"
integrity="sha384-
KK94CHFLLe+nY2dmCWGMq91rCGa5gtU4mk92HdvYe+M/SXH301p5ILy+dN9+nJO
Z" crossorigin="anonymous">
  </head>
  <body>
    <div class='tableauPlaceholder' id='viz1681131711983'
style='position: relative'><noscript><a href='#'><img
alt='Dashboard 3 '
src='https:&#47;&#47;public.tableau.com&#47;static&#47;images&#
47;XQ&#47;XQW2BS4H8&#47;1_rss.png' style='border: none'
/></a></noscript><object
class='tableauViz'  style='display:none;'><param
name='host_url' value='https%3A%2F%2Fpublic.tableau.com%2F' />
<param name='embed_code_version' value='3' /> <param
name='path' value='shared&#47;XQW2BS4H8' /> <param
name='toolbar' value='yes' /><param name='static_image'
value='https:&#47;&#47;public.tableau.com&#47;static&#47;images
```

```
&#47;XQ&#47;XQW2BS4H8&#47;1.png' /> <param
name='animate_transition' value='yes' /><param
name='display_static_image' value='yes' /><param
name='display_spinner' value='yes' /><param
name='display_overlay' value='yes' /><param
name='display_count' value='yes' /><param name='language'
value='en-US' /><param name='filter' value='publish=yes'
/></object></div>                    <script
type='text/javascript'>                    var divElement =
document.getElementById('viz1681131711983');
 var vizElement =
divElement.getElementsByTagName('object')[0];
 if ( divElement.offsetWidth > 800 ) {
vizElement.style.width='100%';vizElement.style.height=(divEleme
nt.offsetWidth*0.75)+'px';} else if ( divElement.offsetWidth >
500 ) {
vizElement.style.width='100%';vizElement.style.height=(divEleme
nt.offsetWidth*0.75)+'px';} else {
vizElement.style.width='100%';vizElement.style.height='1277px';
}                    var scriptElement =
document.createElement('script');                    scriptElem
ent.src =
'https://public.tableau.com/javascripts/api/viz_v1.js';
         vizElement.parentNode.insertBefore(scriptElement,
vizElement);                </script>
            </script>
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/js/bootstrap.bundle.min.js" integrity="sha384-
ENjdO4Dr2bkBIFxQpeoTz1HIcje39Wm4jDKdf19U8gI4ddQ3GYNS7NTKfAdVQSZ
e" crossorigin="anonymous"></script>
  </body>
</html>
```

- **story.html**

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
```

```html
    <meta name="viewport" content="width=device-width, initial-scale=1">
    <title>Bootstrap demo</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-alpha3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384-KK94CHFLLe+nY2dmCWGMq91rCGa5gtU4mk92HdvYe+M/SXH301p5ILy+dN9+nJOZ" crossorigin="anonymous">
  </head>
  <body>
    <div class='tableauPlaceholder' id='viz1680947423254' style='position: relative'><noscript><a href='#'><img alt='Plugging Into The Future:An Exploration of Electricity Consumption Patterns ' src='https:&#47;&#47;public.tableau.com&#47;static&#47;images&#47;6Q&#47;6QQXJZPKN&#47;1_rss.png' style='border: none' /></a></noscript><object class='tableauViz'  style='display:none;'><param name='host_url' value='https%3A%2F%2Fpublic.tableau.com%2F' /> <param name='embed_code_version' value='3' /> <param name='path' value='shared&#47;6QQXJZPKN' /> <param name='toolbar' value='yes' /><param name='static_image' value='https:&#47;&#47;public.tableau.com&#47;static&#47;images&#47;6Q&#47;6QQXJZPKN&#47;1.png' /> <param name='animate_transition' value='yes' /><param name='display_static_image' value='yes' /><param name='display_spinner' value='yes' /><param name='display_overlay' value='yes' /><param name='display_count' value='yes' /><param name='language' value='en-US' /><param name='filter' value='publish=yes' /></object></div>                <script type='text/javascript'>                    var divElement = document.getElementById('viz1680947423254');
 var vizElement = divElement.getElementsByTagName('object')[0];
 vizElement.style.width='1016px';vizElement.style.height='991px';                var scriptElement = document.createElement('script');                    scriptElement.src = 'https://public.tableau.com/javascripts/api/viz_v1.js';
```

```
            vizElement.parentNode.insertBefore(scriptElement,
vizElement);                    </script>
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/js/bootstrap.bundle.min.js" integrity="sha384-
ENjdO4Dr2bkBIFxQpeoTz1HIcje39Wm4jDKdf19U8gI4ddQ3GYNS7NTKfAdVQSZ
e" crossorigin="anonymous"></script>
  </body>
</html>
```

- **conclusion.html**

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-
scale=1">
    <title>Bootstrap demo</title>
    <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/css/bootstrap.min.css" rel="stylesheet"
integrity="sha384-
KK94CHFLLe+nY2dmCWGMq91rCGa5gtU4mk92HdvYe+M/SXH301p5ILy+dN9+nJO
Z" crossorigin="anonymous">
  </head>
  <body>
    <h1 align="center"><p class="text-primary-
emphasis"><u>Conclusion</u></p></h1>
    <h2><u>Total Consumption In States</u></h2>
    <img src= "{{url_for('static', filename='/Image/total
consumption.png')}}" width="1000" height="600">
    <style type="text/css">
ul
{
 list-style: none;
}
ul li {
 background:
url(https://www.computerhope.com/issues/pictures/bullet.gif)
no-repeat top left;
 background-position: 0 5px;
```

```html
 line-height: 2.0;
 padding: 0 0 4px 30px;
 margin-left: 1em;
}
</style>
 <ul>
 <li style="font-size:20px;">Maharastra is the highest
electricity consuming state than other states.</li>
 <li style="font-size:20px;">Gujarat is the second highest
electricity consuming state than the other states.</li>
 <li style="font-size:20px;">Sikkim has the lowest rate of
electricity consumption state in india.</li>
</ul>
<h3><u>Electricity Usage Before and During the
Lockdown</u></h3>
<img src= "{{url_for('static', filename='/Image/usage
lockdown.png')}}" width="1000" height="500">

    <style type="text/css">
ul
{
 list-style: none;
}
ul li {
 background:
url(https://www.computerhope.com/issues/pictures/bullet.gif)
no-repeat top left;
 background-position: 0 5px;
 line-height: 2.0;
 padding: 0 0 4px 30px;
 margin-left: 1em;
}
</style>
 <ul>
 <li style="font-size:20px;">In 2019,electricity usage during
march,april,may,june is higher than 2020.</li>
 <li style="font-size:20px;">June month in 2020 had recorded
the lowest consumption of electricity, which is after the
lockdown.</li>
```

```html
 <li style="font-size:20px;">April month in 2020 had recorded
the highest consumption of electricity, which is after the
lockdown.</li>
</ul>
<h4><u>Electricity Usage by Region</u></h4>
<img src= "{{url_for('static', filename='/Image/region
usage.png')}}" width="1000" height="500">

    <style type="text/css">
ul
{
 list-style: none;
}
ul li {
 background:
url(https://www.computerhope.com/issues/pictures/bullet.gif)
no-repeat top left;
 background-position: 0 5px;
 line-height: 2.0;
 padding: 0 0 4px 30px;
 margin-left: 1em;
}
</style>
 <ul>
 <li style="font-size:20px;">Western region is the highest
consumer of electricity during 2019 and 2020.</li>
 <li style="font-size:20px;">Northern region is the second
highest consumer of electricity during 2019 and 2020.</li>
 <li style="font-size:20px;">North Eastern region is the lowest
consumer of electricity during 2019 and 2020.</li>
</ul>

    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.3.0-
alpha3/dist/js/bootstrap.bundle.min.js" integrity="sha384-
ENjdO4Dr2bkBIFxQpeoTz1HIcje39Wm4jDKdf19U8gI4ddQ3GYNS7NTKfAdVQSZ
e" crossorigin="anonymous"></script>
  </body>
</html>
```