0 % SSD

Namenode Created.
0 SSD Datanodes Created.
100 HDD Datanodes Created.

700 Watts of Power consumed for bringing up 100 Nodes
345000 Watts of Power consumed for initial block distribution (First write)
54000 Watts of Power consumed for initial Block access (First Read of data)
235 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
0 Watts of Power consumed when transferring data to cold zone
120000 Watts of Power consumed for block balancing
235 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
230000 Watts of Power consumed for continued Block access (Regular reading of data)

Total power consumed = 750170

30% SSD

Namenode Created.
30 SSD Datanodes Created.
70 HDD Datanodes Created.
5 SSD Datanodes Active.

635 Watts of Power consumed for bringing up 100 Nodes
150000 Watts of Power consumed for initial block distribution (First write)
18000 Watts of Power consumed for initial Block access (First Read of data)
205 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
184000 Watts of Power consumed when transferring data to cold zone
12000 Watts of Power consumed for block balancing
191 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
37167 Watts of Power consumed for continued Block access (Regular reading of data)

Total power consumed = 402198

50% SSD

Namenode Created.
50 SSD Datanodes Created.
50 HDD Datanodes Created.
5 SSD Datanodes Active.

595 Watts of Power consumed for bringing up 100 Nodes
150000 Watts of Power consumed for initial block distribution (First write)
18000 Watts of Power consumed for initial Block access (First Read of data)
185 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
184000 Watts of Power consumed when transferring data to cold zone
12000 Watts of Power consumed for block balancing
171 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
37147 Watts of Power consumed for continued Block access (Regular reading of data)

Total power consumed = 402098

100% SSD

Namenode Created.
100 SSD Datanodes Created.
0 HDD Datanodes Created.
5 SSD Datanodes Active.

495 Watts of Power consumed for bringing up 100 Nodes
150000 Watts of Power consumed for initial block distribution (First write)
18000 Watts of Power consumed for initial Block access (First Read of data)
135 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
60000 Watts of Power consumed for block balancing
142 Watts of Power consumed for maintaining the infrastructure (Cluster in active state)
150094 Watts of Power consumed for continued Block access (Regular reading of data)

Total power consumed = 378866

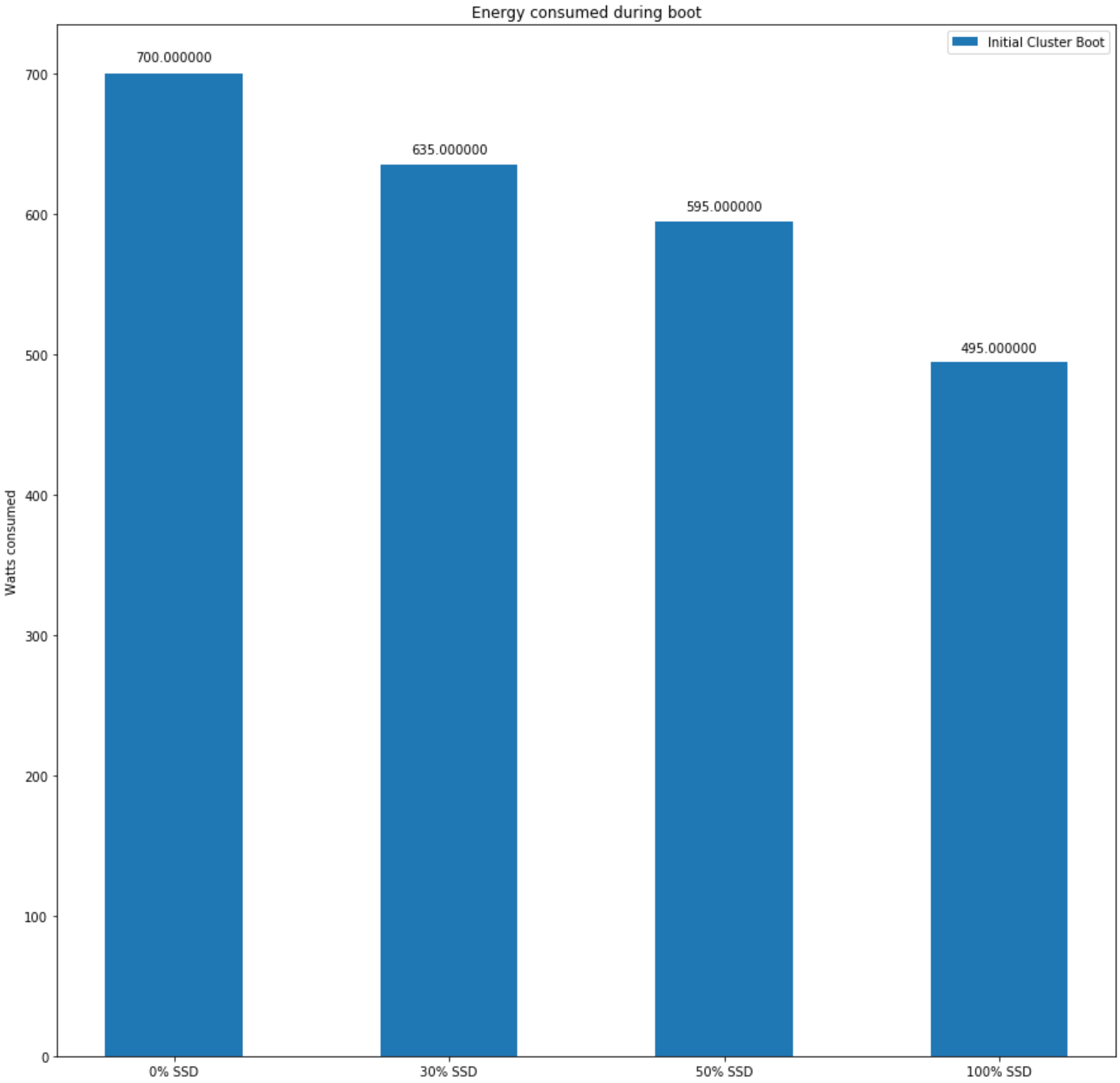
```
import numpy as np
import matplotlib.pyplot as plt
```

```
N = 4

labels = ['0% SSD', '30% SSD', '50% SSD', '100% SSD']

cluster_boot = (700, 635, 595, 495)
first_write = (345000, 150000, 150000, 150000)
first_read = (54000, 18000, 18000, 18000)
cluster_active_1 = (235, 205, 185, 135)
transfer_to_cold_zone = (0, 184000, 184000, 0)
block_balancing = (120000, 12000, 12000, 60000)
cluster_active_2 = (235, 191, 171, 142)
continued_read = (230000, 37167, 37147, 150094)

total = (750170, 402198, 402098, 378866)
```

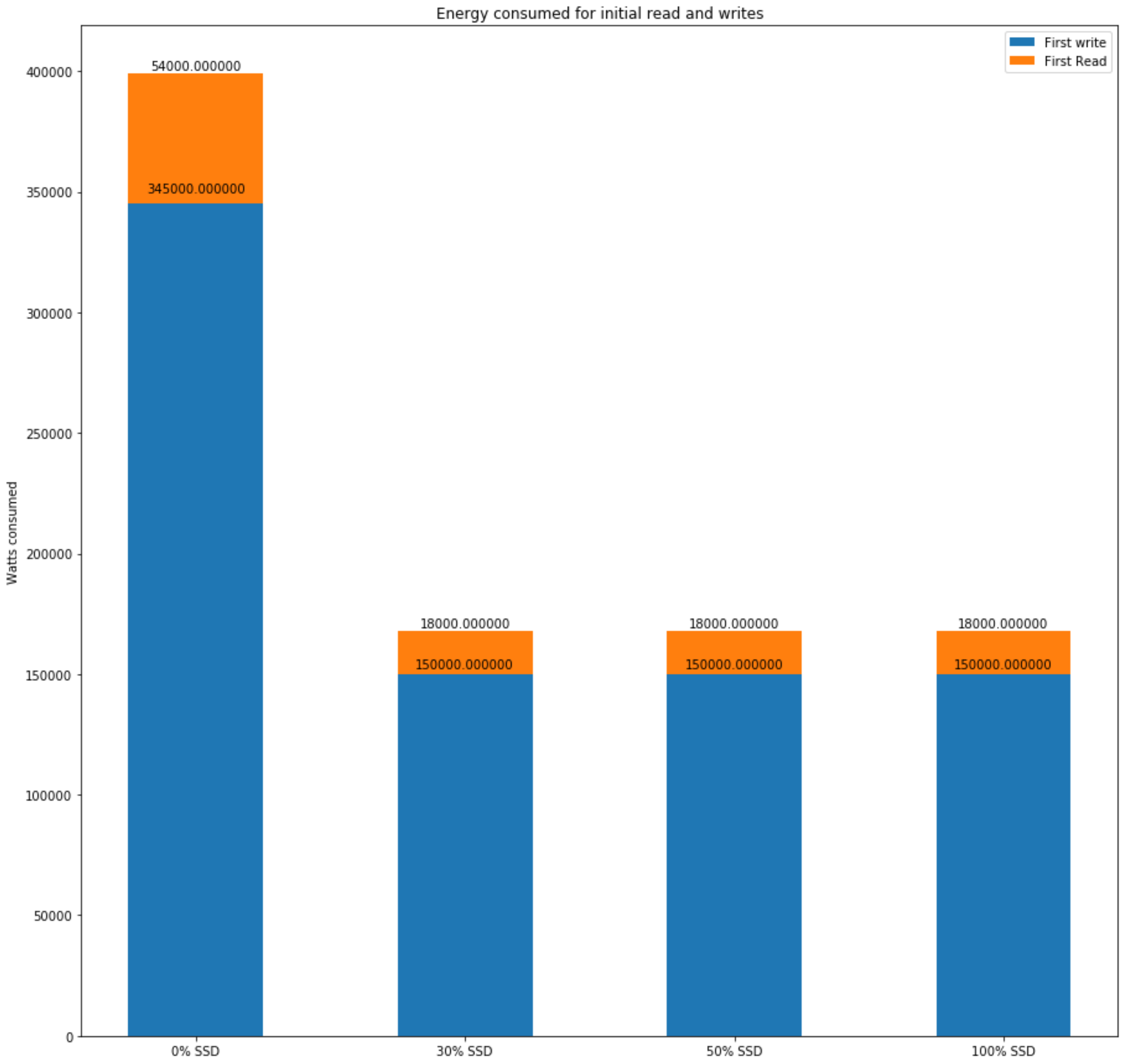
```
ind = np.arange(N)
width = 0.5
plt.rcParams['figure.figsize'] = (15,15)

def autolabel2(rects):
    for rect in rects:
        height = rect.get_height()
        heights.append(height)
        ax.text(rect.get_x() + rect.get_width()/2., 1.01*height,'%f' % int(height),ha='center', va='bottom')


def autolabel(rects):
    i = 0
    for rect in rects:
        height = rect.get_height()
        ax.text(rect.get_x() + rect.get_width()/2., 1.01*height + heights[i],'%f' % int(height),ha='center', 
        i += 1
```

```
heights = []
fig, ax = plt.subplots()
rects1 = ax.bar(labels, cluster_boot, width, label = 'Initial Cluster Boot')
ax.set_ylabel('Watts consumed')
ax.set_title('Energy consumed during boot')
ax.legend()
```

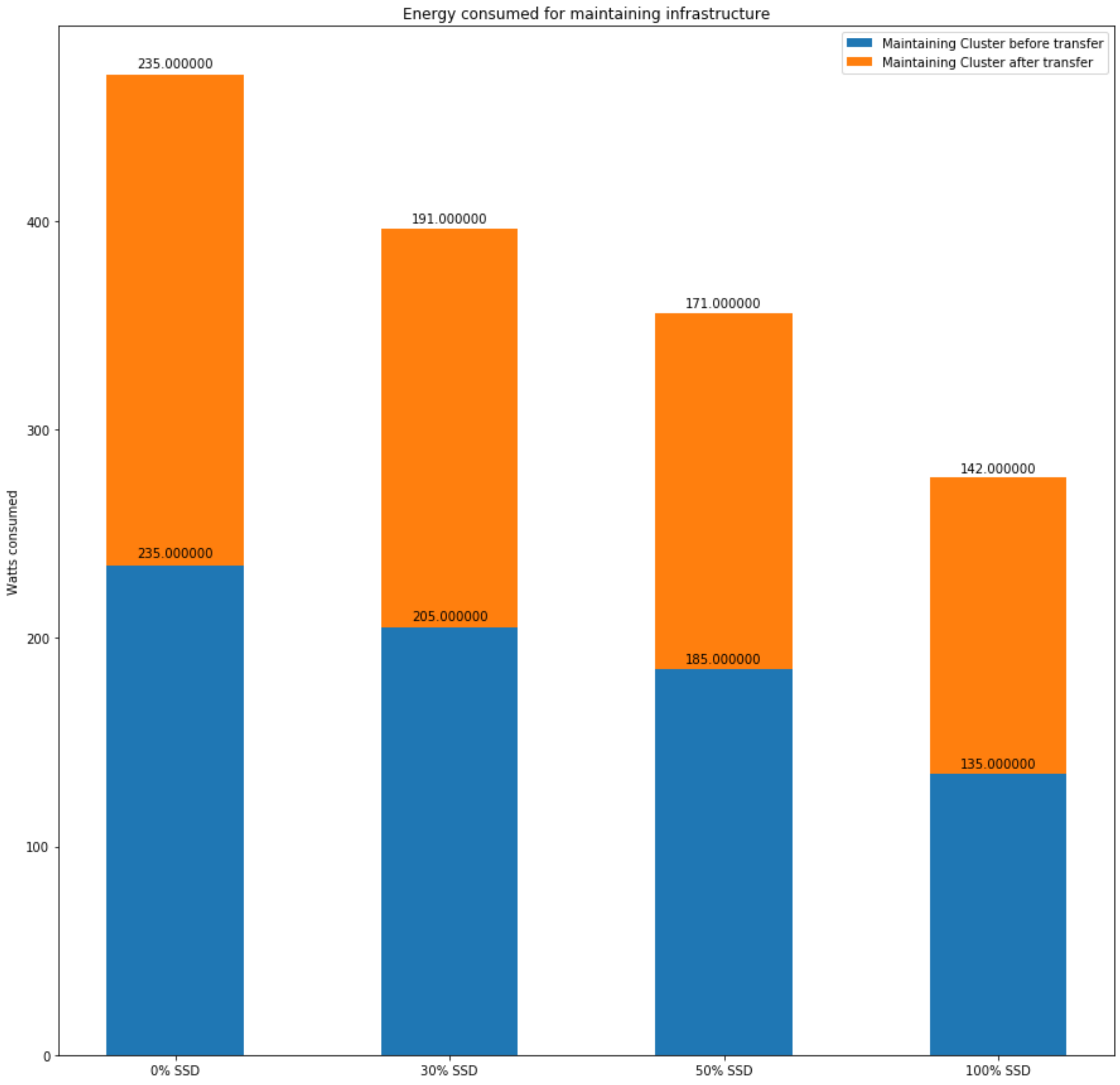
```
autolabel2(rects1)
plt.show()
```



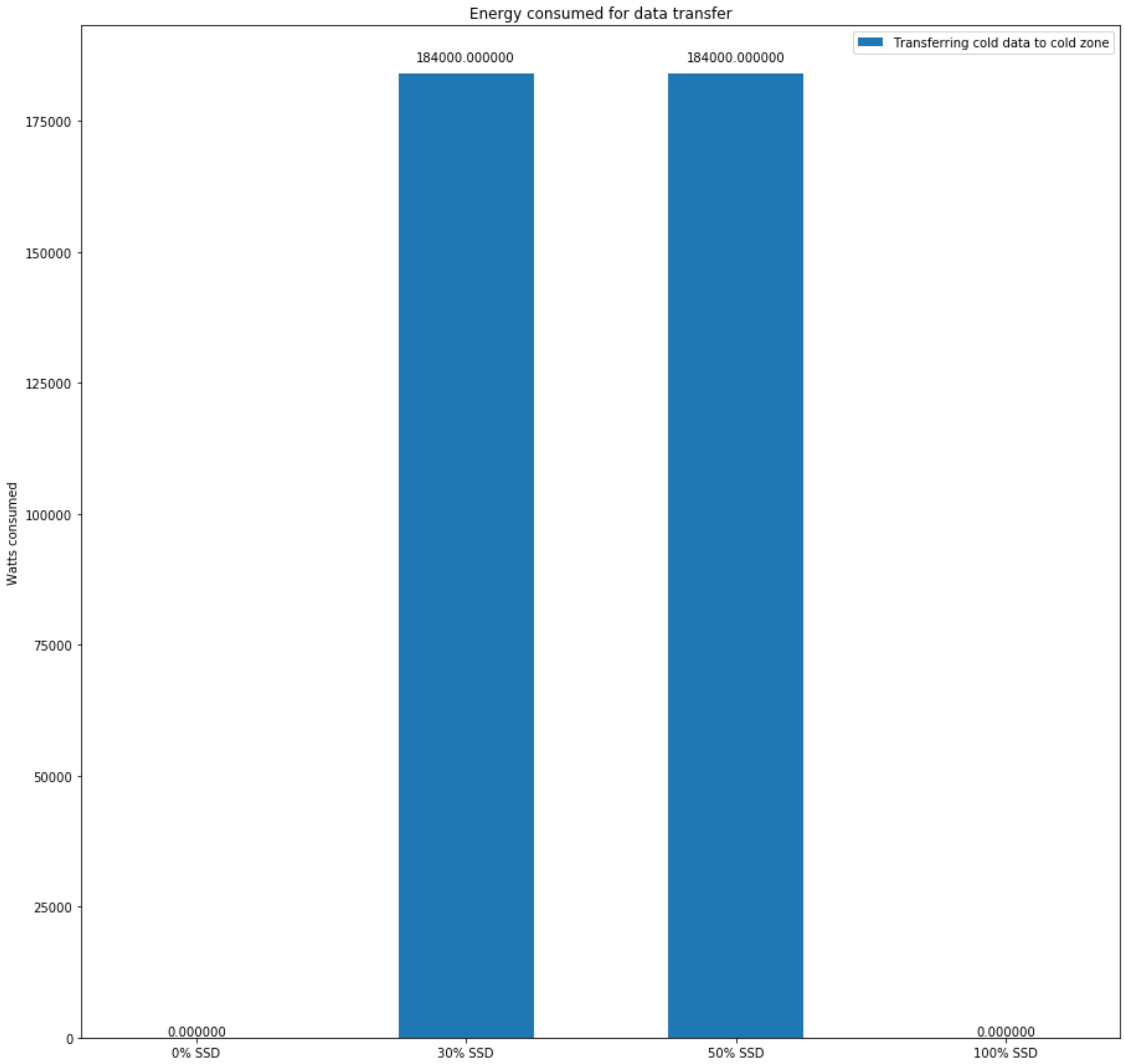
```
heights = []

fig, ax = plt.subplots()
rects1 = ax.bar(labels, first_write, width, label = 'First write')
rects2 = ax.bar(labels, first_read, width, bottom = first_write, label = 'First Read')
ax.set_ylabel('Watts consumed')
ax.set_title('Energy consumed for initial read and writes')
autolabel2(rects1)
autolabel(rects2)
ax.legend()
plt.show()
```



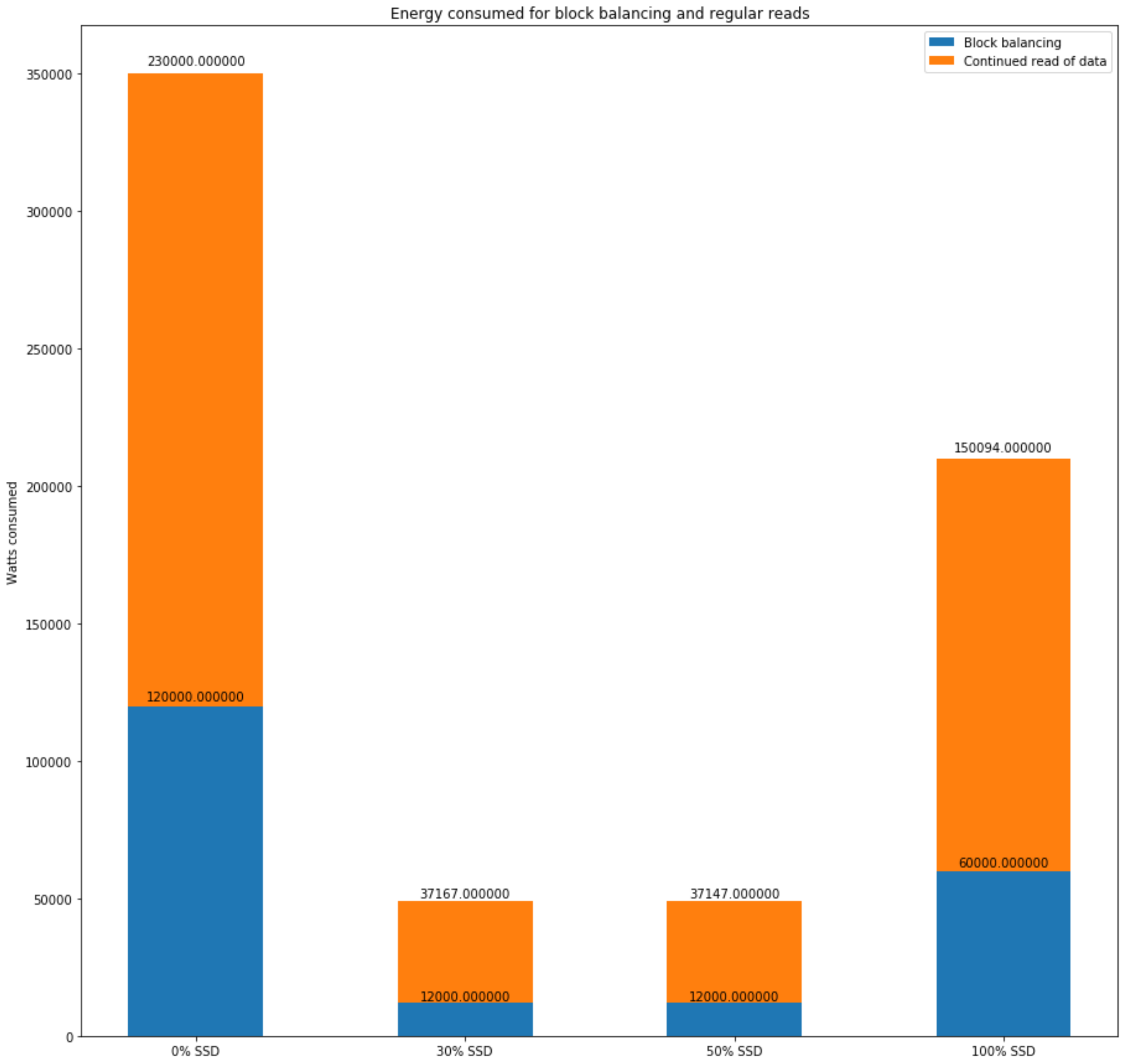
```
heights = []
fig, ax = plt.subplots()
rects1 = ax.bar(labels, cluster_active_1, width, label = 'Maintaining Cluster before transfer')
rects2 = ax.bar(labels, cluster_active_2, width, bottom = cluster_active_1, label = 'Maintaining Cluster afte
ax.set_ylabel('Watts consumed')
ax.set_title('Energy consumed for maintaining infrastructure')
ax.legend()
autolabel2(rects1)
autolabel(rects2)
plt.show()
```



```
fig, ax = plt.subplots()
rects1 = ax.bar(labels, transfer_to_cold_zone, width, label = 'Transferring cold data to cold zone')
#ax.bar(labels, cluster_active_2, width, bottom = cluster_active_1, label = 'Maintaining Cluster after transf
ax.set_ylabel('Watts consumed')
ax.set_title('Energy consumed for data transfer')
ax.legend()
autolabel2(rects1)
plt.show()
```

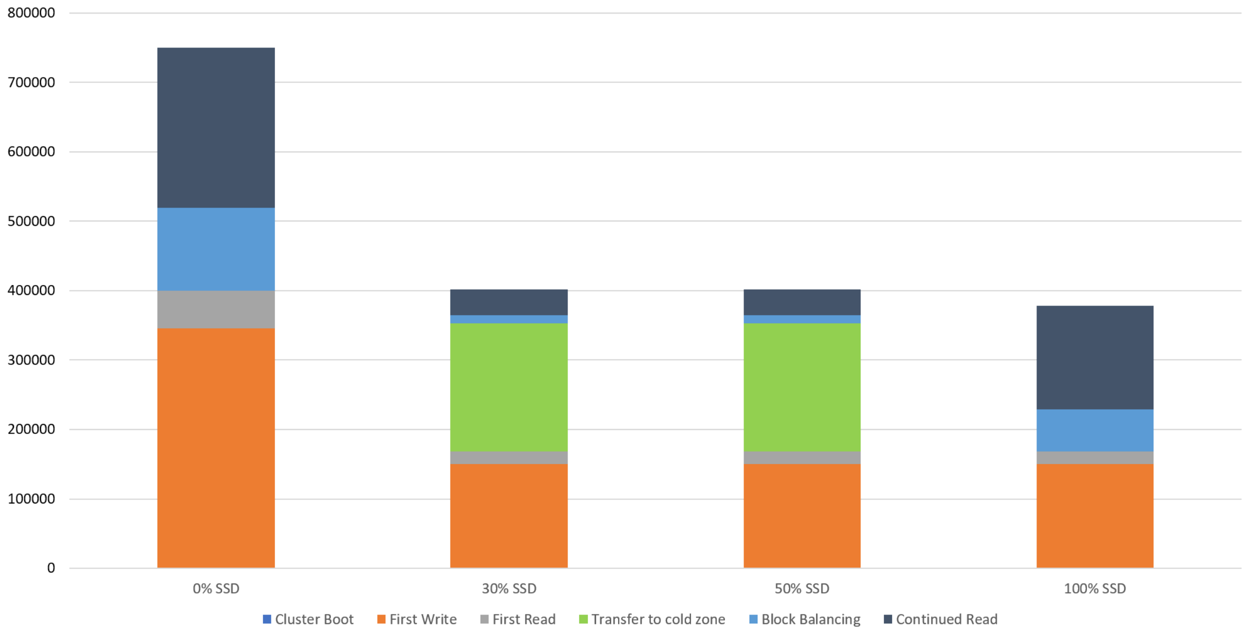


```python
heights = []
fig, ax = plt.subplots()
rects1 = ax.bar(labels, block_balancing, width, label = 'Block balancing')
rects2 = ax.bar(labels, continued_read, width, bottom = block_balancing, label = 'Continued read of data')
ax.set_ylabel('Watts consumed')
ax.set_title('Energy consumed for block balancing and regular reads')
ax.legend()
autolabel2(rects1)
autolabel(rects2)
plt.show()
```



```
fig, ax = plt.subplots()
#ax.bar(labels, cluster_boot, width, label = 'Initial Cluster Boot')
#ax.bar(labels, cluster_active_1, width, bottom = cluster_boot, label = 'Cluster Active')

rects1 = ax.bar(labels, total, width, label = 'Total Energy Consumption')

ax.set_ylabel('Watts consumed')
ax.set_title('Total Energy Consumed')
autolabel2(rects1)
ax.legend()

plt.show()
```

Total power consumption in HDFS cluster


0% SSD
30% SSD
50% SSD
100% SSD
Cluster Boot
First Write
First Read
Transfer to cold zone
Block Balancing
Continued Read