Task 3. Write a function (on python), which for given (λ, n) generates a sample of size n from the distribution $Exp(\lambda)$. $F_\nu(x) = 1 - e^{-\lambda x}, \nu \sim Exp(\lambda)$.

Given that $F_\nu(x) = 1 - e^{-\lambda x}$, we can calculate that $F_\nu^{-1}(x) = -\frac{1}{\lambda} ln(1 - x)$. Let's use the inverse function method which stands that given the uniform distribution $\mathcal{U}(0, 1)$ we can generate a sample from any other distribution by substitution the uniform distribution into the inverse function.

This results in that $-\frac{1}{\lambda} ln(1 - \mathcal{U}(0, 1)) \sim Exp(\lambda)$

Let's implement the stuff discussed before. In addition to that let's compare the results generated by our generator and by the scipy `expon` class. We can see that the results we get are very close to each other.

In [1]:
```
from random import random
from math import log
from scipy.stats import expon
import matplotlib.pyplot as plt
```

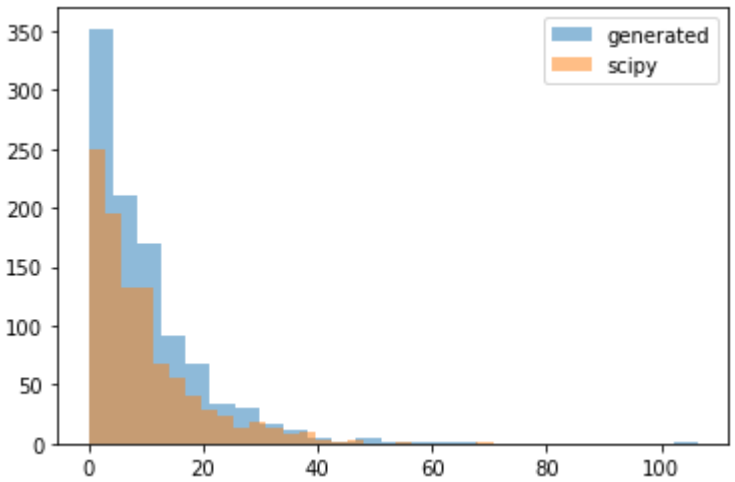
In [2]:
```
def generate_exp(l, n):
    return [-log(1 - random()) / l for i in range(n)]
```

In [3]:
```
lambda_parameter = 0.1

generated = generate_exp(lambda_parameter, 1000)
check = expon.rvs(size=1000, scale=1/lambda_parameter)

plt.hist(generated, alpha=0.5, bins=25, label='generated')
plt.hist(check, alpha=0.5, bins=25, label='scipy')
plt.legend()
```

Out[3]: `<matplotlib.legend.Legend at 0x2baf7ad6f08>`

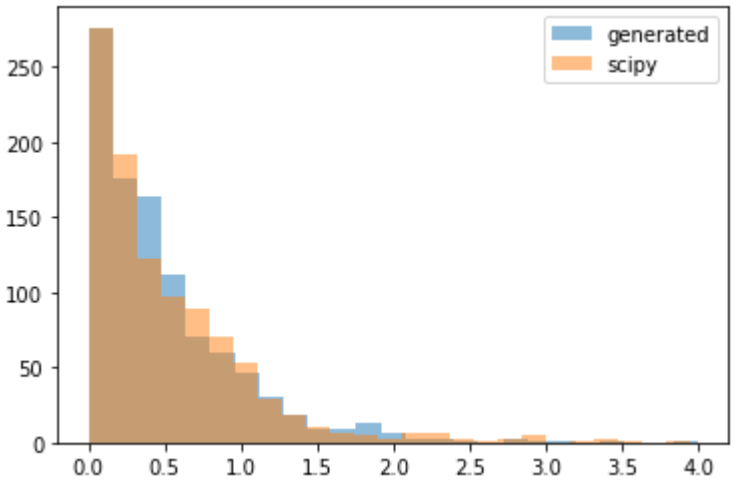


In [4]:
```
lambda_parameter = 2

generated = generate_exp(lambda_parameter, 1000)
check = expon.rvs(size=1000, scale=1/lambda_parameter)

plt.hist(generated, alpha=0.5, bins=25, label='generated')
plt.hist(check, alpha=0.5, bins=25, label='scipy')
plt.legend()
```

Out[4]: <matplotlib.legend.Legend at 0x2baf7ad83c8>

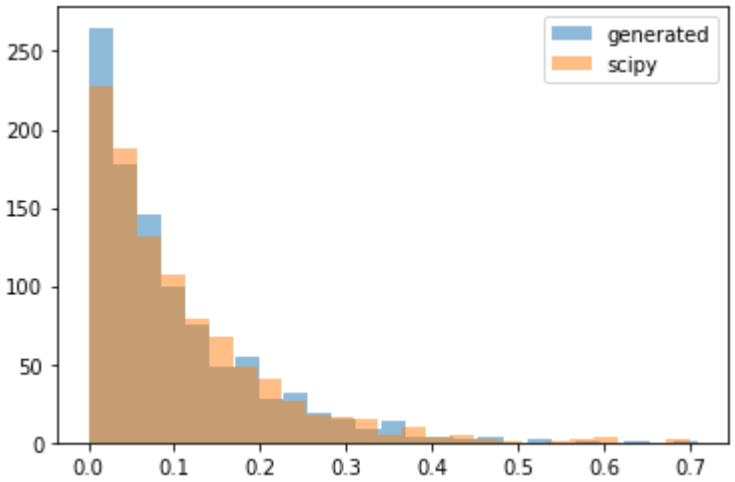


In [5]:
```
lambda_parameter = 10

generated = generate_exp(lambda_parameter, 1000)
check = expon.rvs(size=1000, scale=1/lambda_parameter)

plt.hist(generated, alpha=0.5, bins=25, label='generated')
plt.hist(check, alpha=0.5, bins=25, label='scipy')
plt.legend()
```

Out[5]: <matplotlib.legend.Legend at 0x2baf8324248>



In [ ]: