ACTIVITY 4 (lecture in Mexico)

Individual assignment

1. Estimation of energy consumption in YOUR house

Describe your house (how many bedrooms, kitchen, dining room, living room, bathrooms, studio, etc). Estimate the daily electric energy consumption by filling the following table (assume the highest consumption of the year):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Appliance | Power (W) | Hours of use per day | kW-hr / day | kW-hr / month |
| Lighting | 48 W | 5 | 240 | 7200 |
| Refrigerator | 359 W | 4 | 0.9972 | 29.91 |
| Heating/AC | -------------------- | ---------------------- | ---------------------- | ---------------------- |
| Dish washer | ---------------------- | ---------------------- | ---------------------- | ---------------------- |
| Microwave oven | 1000 W | 0.05 | 50 | 15000 |
| Stove | 2110 W | 0.033 | 33 | 990 |
| Oven | ---------------------- | ----------------------- | ---------------------- | ----------------------- |
| TVs | 400 W | 2 | 80 | 2400 |
| Other electronics  (computers, cell phones, etc) | 64750 W 15030 W 10710 W | 2 1.5 2 | 129.5 22.545 21.42 | 3885 676.35 642.6 |
| Others (optional) | 2000 W | 0.1428 | 0.2857 | 8.5714 |
|  |  |  |  |  |
| TOTAL | 96407 W | 16.7258 | 577.7479 | 30832.4314 |
|  |  |  |  |  |

Try to adjust your values based on your electricity bill.

1. Calculation of energy required to be produced by a solar system

**Calculate the total kw-hr/day your system would need to produce**

Take into account the following loss factors:

Losses due to dust on the panels =3% →Efficiency=1-.03=97%

Losses due to invertor´s efficiency =2.5% → Efficiency =1-.025=97.5%

Losses due to cabling=3% → Efficiency =1-.03=97%

Other losses=2% → Efficiency =1-.02=98%

|  |  |
| --- | --- |
| **Application** | **Kw-hr/day (89.5% Efficiency)** |
| Lighting | 214.8 |
| Refrigerator | 0.8924 |
| Microwave oven | 44.75 |
| Stove | 29.535 |
| TV´s | 71.6 |
| Computer | 115.9025 |
| Cellphone | 20.1777 |
| Tablet | 19.1709 |
| Laundry machine | 0.25570 |
|  |  |
| TOTAL | 517.0842 |

1. Sizing the pv system to an specific location

Use the average monthly Global Horizontal Irradiance (GHI) per square meter per day (kWh/m2/day) corresponfing to your location (use attached table)

Divide the total kw-hr/day by the average monthly Global Horizontal Irradiance the result is the power-size of your system

Choose on panel from the three data sheets provided (Sharp, Solarworld and Kyocera)

How many panels would you need?

What area would the panels use in m2?

Suppose a residential cost of $1,600 per kW (residential rates), what would be the cost of your system?

**Anexos**

**Anexo 10.1 Tabla de irradiación promedio por mes en kWh/m2-día en distintas ciudades del territorio nacional, ordenadas por irradiación media. Fuente: CONUEE, 2008.**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Estado** | **Ciudad** | **Ene** | **Feb** | **Mar** | **Abr** | **May** | **Jun** | **Jul** | **Ago** | **Sep** | **Oct** | **Nov** | **Dic** | **Mín.** | **Máx.** | **Med.** |
| **Sonora** | **Hermosillo** | **4** | **4.6** | **5.4** | **6.6** | **8.3** | **8.6** | **6.9** | **6.6** | **6.7** | **6** | **4.7** | **3.9** | **3.9** | **8.6** | **6** |
| **Sonora** | **San Luis Río Colorado** | **3.4** | **3.8** | **4.9** | **6.2** | **7.3** | **7.4** | **6.9** | **6.1** | **5.1** | **4.05** | **3.3** | **2.8** | **2.8** | **7.4** | **6** |
| **Sonora** | **Guaymas** | **4.5** | **5.7** | **6.5** | **7.2** | **7.3** | **6.8** | **5.9** | **5.8** | **6.3** | **5.9** | **5.1** | **5.6** | **4.5** | **7.3** | **6** |
| **Jalisco** | **Colotlán** | **4.6** | **5.7** | **6.5** | **7.5** | **8.2** | **6.6** | **5.8** | **5.6** | **5.8** | **5.3** | **4.9** | **4.1** | **4.1** | **8.2** | **5.9** |
| **Chihuahua** | **Chihuahua** | **4.1** | **4.9** | **6** | **7.4** | **8.2** | **8.1** | **6.8** | **6.2** | **5.7** | **5.2** | **4.6** | **3.8** | **3.8** | **8.2** | **5.9** |
| **Querétaro** | **Querétaro** | **5** | **5.7** | **6.4** | **6.8** | **6.9** | **6.4** | **6.4** | **6.4** | **6.3** | **5.4** | **5** | **4.4** | **4.4** | **6.9** | **5.9** |
| **Zacatecas** | **Zacatecas (La Bufa)** | **4.9** | **5.7** | **6.6** | **7.5** | **7.8** | **6.2** | **6.2** | **5.9** | **5.4** | **4.8** | **4.8** | **4.1** | **4.1** | **7.8** | **5.8** |
| **Oaxaca** | **Salina Cruz** | **5.4** | **6.3** | **6.6** | **6.4** | **6.1** | **5** | **5.6** | **5.9** | **5.2** | **5.9** | **5.7** | **5.2** | **5** | **6.6** | **5.8** |
| **Sonora** | **Cd. Obregón** | **3.6** | **4.5** | **5.9** | **7.1** | **7.7** | **7.5** | **6.07** | **5.8** | **5.6** | **4.9** | **4.09** | **3.4** | **3.4** | **7.7** | **5.7** |
| **Durango** | **Durango** | **4.4** | **5.4** | **6.5** | **7** | **7.5** | **6.8** | **6** | **5.6** | **5.7** | **5.1** | **4.8** | **3.9** | **3.9** | **7.5** | **5.7** |
| **Baja California** | **La Paz** | **4.4** | **5.5** | **6** | **6.6** | **6.5** | **6.6** | **6.3** | **6.2** | **5.9** | **5.8** | **4.9** | **4.2** | **4.2** | **6.6** | **5.7** |
| **Jalisco** | **Guadalajara** | **4.6** | **5.5** | **6.3** | **7.4** | **7.7** | **5.9** | **5.3** | **5.3** | **5.2** | **4.9** | **4.8** | **4** | **4** | **7.7** | **5.6** |
| **Aguascalientes** | **Aguascalientes** | **4.5** | **5.2** | **5.9** | **6.6** | **7.2** | **6.3** | **6.1** | **5.9** | **5.7** | **5.1** | **4.8** | **4** | **4** | **7.2** | **5.6** |
| **Guerrero** | **Cd. Altamirano** | **4.8** | **5.5** | **6.4** | **6.7** | **6.6** | **5.7** | **5.9** | **5.8** | **5.2** | **5.3** | **5** | **4.1** | **4.1** | **6.7** | **5.6** |
| **Guanajuato** | **Guanajuato** | **4.4** | **5.1** | **6.1** | **6.3** | **6.6** | **6** | **6** | **5.9** | **5.8** | **5.2** | **4.8** | **4.6** | **4.4** | **6.6** | **5.6** |
| **Baja California** | **Mexicali** | **4.1** | **4.4** | **5** | **5.6** | **6.6** | **7.3** | **7** | **6.1** | **6.1** | **5.5** | **4.5** | **3.9** | **3.9** | **7.3** | **5.5** |
| **Jalisco** | **Lagos de Moreno** | **4.5** | **5.3** | **6.1** | **6.7** | **7.2** | **6.1** | **5.8** | **5.6** | **5.5** | **5** | **4.7** | **4** | **4** | **7.2** | **5.5** |
| **Baja California** | **San Javier** | **4.2** | **4.6** | **5.3** | **6.2** | **6.5** | **7.1** | **6.4** | **6.3** | **6.4** | **5.1** | **4.7** | **3.7** | **3.7** | **7.1** | **5.5** |
| **Tamaulipas** | **Matamoros** | **2.9** | **3.9** | **5.3** | **6** | **6.7** | **7** | **6.8** | **6.7** | **5.5** | **5.1** | **3.7** | **2.8** | **2.8** | **7** | **5.5** |
| **Puebla** | **Puebla** | **4.9** | **5.5** | **6.2** | **6.4** | **6.1** | **5.7** | **5.8** | **5.8** | **5.2** | **5** | **4.7** | **4.4** | **4.4** | **6.4** | **5.5** |
| **Hidalgo** | **Pachuca** | **4.6** | **5.1** | **5.6** | **6.8** | **6** | **5.7** | **5.9** | **5.8** | **5.3** | **4.9** | **4.6** | **4.2** | **4.2** | **6.8** | **5.4** |
| **San Luis Potosí** | **San Luis Potosí** | **4.3** | **5.3** | **5.8** | **6.4** | **6.3** | **6.1** | **6.4** | **6** | **5.5** | **4.7** | **4.2** | **3.7** | **3.7** | **6.4** | **5.4** |
| **Chiapas** | **Arraiga** | **5.1** | **5.4** | **5.5** | **5.9** | **5.6** | **5.2** | **5.9** | **5.5** | **5.1** | **5.3** | **5.1** | **4.7** | **4.7** | **5.9** | **5.4** |
| **Quintana Roo** | **Playa del Carmen** | **4.1** | **5** | **5.8** | **6.6** | **6.3** | **6.1** | **6.1** | **6** | **5.3** | **4.8** | **4.3** | **3.9** | **3.9** | **6.6** | **5.3** |
| **Guerrero** | **Acapulco** | **4.8** | **5.3** | **6.1** | **5.9** | **5.6** | **5.1** | **5.3** | **5.4** | **4.9** | **5.2** | **5** | **4.7** | **4.7** | **6.1** | **5.3** |
| **Oaxaca** | **Oaxaca** | **4.9** | **5.7** | **5.8** | **5.5** | **6** | **5.4** | **5.9** | **5.6** | **5** | **4.9** | **4.8** | **4.4** | **4.4** | **6** | **5.3** |
| **Sonora** | **Nogales** | **3.1** | **3.9** | **5.2** | **6.5** | **7** | **7** | **6.1** | **5.6** | **5.2** | **4.3** | **3.5** | **2.9** | **2.9** | **7** | **5.2** |
| **Veracruz** | **San Andrés Tuxtla** | **3.5** | **4.4** | **5.6** | **6.6** | **6.5** | **5.8** | **5.8** | **5.6** | **4.9** | **4.6** | **3.9** | **3.4** | **3.4** | **6.6** | **5.2** |
| **México** | **Chapingo** | **4.5** | **5.1** | **5.6** | **5.8** | **5.9** | **5.4** | **5.2** | **5.2** | **5** | **4.7** | **4.6** | **3.9** | **3.9** | **5.9** | **5.1** |
| **Tlaxcala** | **Tlaxcala** | **4.6** | **5.1** | **5.5** | **5.4** | **5.6** | **5.2** | **5.3** | **5.2** | **5.1** | **4.9** | **4.7** | **4** | **4** | **5.6** | **5.1** |
| **Chihuahua** | **Cd. Juárez** | **3.1** | **3.9** | **5.2** | **6.4** | **6.9** | **7** | **6.4** | **5.6** | **5** | **4.2** | **3.5** | **2.9** | **2.9** | **7** | **5** |
| **Veracruz** | **Poza Rica** | **3.1** | **4** | **5** | **5.9** | **6.4** | **6.1** | **5.8** | **5.9** | **5.1** | **4.8** | **3.3** | **3.1** | **3.1** | **6.4** | **5** |
| **Sinaloa** | **Culiacán** | **3.6** | **4.2** | **4.8** | **5.4** | **6.2** | **6.2** | **5.4** | **5.1** | **5.2** | **4.6** | **4.2** | **3.4** | **3.4** | **6.2** | **4.9** |
| **Colima** | **Colima** | **4.4** | **5.1** | **5.3** | **5.8** | **6** | **5.2** | **4.9** | **5** | **4.6** | **4.4** | **4.4** | **3.9** | **3.9** | **6** | **4.9** |
| **Michoacán** | **Morelia** | **4.2** | **4.9** | **5.5** | **5.8** | **5.9** | **5.2** | **5** | **5.1** | **4.9** | **4.6** | **4.3** | **3.7** | **3.7** | **5.9** | **4.9** |
| **D.F.** | **Tacubaya** | **4.4** | **5.2** | **5.8** | **5.8** | **5.7** | **5.1** | **4.9** | **4.9** | **4.7** | **4.4** | **4.2** | **3.8** | **3.8** | **5.8** | **4.9** |
| **Sinaloa** | **Mazatlán** | **3.9** | **4.8** | **5.4** | **5.7** | **5.7** | **5.6** | **4.8** | **4.9** | **4.7** | **5** | **4.5** | **3.9** | **3.9** | **5.7** | **4.9** |
| **Yucatán** | **Progreso** | **4.1** | **4.9** | **5.4** | **5.5** | **5.3** | **5.1** | **5.3** | **5.3** | **5** | **5** | **4.4** | **4** | **4** | **5.5** | **4.9** |
| **Nayarit** | **Tepic** | **3.9** | **4.3** | **4.8** | **5.5** | **6.1** | **5.3** | **4.9** | **5.3** | **4.4** | **4.4** | **4** | **4.8** | **3.9** | **6.1** | **4.8** |
| **Coahuila** | **Saltillo** | **3.8** | **4.2** | **4.8** | **5.1** | **5.6** | **5.9** | **5.9** | **5.6** | **5.2** | **4.4** | **3.6** | **3.3** | **3.3** | **5.9** | **4.8** |
| **México** | **Toluca** | **4.4** | **4.9** | **5.3** | **5.4** | **5.2** | **5.2** | **4.9** | **4.9** | **4.6** | **4.4** | **4.2** | **3.9** | **3.9** | **5.4** | **4.8** |
| **Campeche** | **Campeche** | **4** | **4.1** | **5.5** | **5.8** | **5.5** | **4.9** | **4.9** | **5.1** | **4.7** | **4.4** | **4.2** | **3.7** | **3.7** | **5.8** | **4.7** |
| **San Luis Potosí** | **Río Verde** | **3.6** | **4** | **4.6** | **4.9** | **5.4** | **5.6** | **5.8** | **5.8** | **5.1** | **4.3** | **3.7** | **3.3** | **3.3** | **5.8** | **4.7** |
| **Quintana Roo** | **Cozumel** | **3.9** | **4.6** | **5.3** | **5.7** | **5.2** | **4.8** | **4.9** | **4.9** | **4.6** | **4.4** | **4** | **3.8** | **3.8** | **5.7** | **4.7** |
| **Quintana Roo** | **Chetumal** | **3.9** | **4.7** | **5.4** | **5.7** | **5.3** | **4.7** | **4.9** | **5** | **4.5** | **4.4** | **4** | **3.7** | **3.7** | **5.7** | **4.7** |
| **Yucatán** | **Mérida** | **3.7** | **4** | **4.6** | **5.2** | **5.7** | **5.5** | **5.7** | **5.5** | **5** | **4.2** | **3.8** | **3.4** | **3.4** | **5.7** | **4.7** |
| **Chiapas** | **Tapachula** | **5.4** | **4.9** | **4.8** | **4.6** | **4.7** | **4.7** | **5.2** | **5.1** | **4.6** | **4.1** | **4.3** | **4.1** | **4.1** | **5.4** | **4.7** |
| **Chiapas** | **Tuxtla Gutiérrez** | **3.8** | **4.4** | **4.6** | **4.8** | **5.3** | **5.1** | **5.4** | **5.3** | **4.9** | **4.4** | **4.1** | **3.7** | **3.7** | **5.4** | **4.7** |
| **Guerrero** | **Chilpancingo** | **4.1** | **4.5** | **4.9** | **5.2** | **5.2** | **5.2** | **5.1** | **5.1** | **4.7** | **4.4** | **4.1** | **3.8** | **3.8** | **5.2** | **4.7** |
| **Morelos** | **Cuautla** | **3.2** | **3.9** | **4.7** | **5.5** | **5.7** | **5.4** | **5.4** | **5.3** | **4.6** | **4.4** | **3.7** | **3.1** | **3.1** | **5.7** | **4.6** |
| **Chiapas** | **Comitán** | **4.1** | **4.4** | **4.8** | **4.9** | **5.1** | **4.8** | **5.5** | **5.5** | **4.8** | **4** | **4** | **3.7** | **3.7** | **5.5** | **4.6** |
| **Tamaulipas** | **Soto la Marina** | **3.4** | **4.2** | **4.9** | **4.9** | **5.1** | **5.3** | **5.4** | **5.4** | **4.9** | **4.6** | **3.7** | **3.2** | **3.2** | **5.4** | **4.6** |
| **Veracruz** | **Veracruz** | **3.7** | **4.5** | **4.9** | **5.1** | **5.1** | **4.8** | **4.7** | **5.1** | **4.6** | **4.8** | **4.1** | **3.6** | **3.6** | **5.1** | **4.6** |
| **Coahuila** | **Piedras Negras** | **3.1** | **3.6** | **4.2** | **4.5** | **4.8** | **6** | **6.7** | **6.3** | **4.9** | **4.1** | **3.3** | **2.9** | **2.9** | **6.7** | **4.5** |
| **Tamaulipas** | **Tampico** | **3.3** | **4.1** | **4.7** | **6.4** | **5** | **4.9** | **4.9** | **4.9** | **4.6** | **4.6** | **3.7** | **3.2** | **3.2** | **6.4** | **4.5** |
| **Tamaulipas** | **Reynosa** | **2.6** | **3.5** | **4.6** | **5.3** | **5.7** | **6** | **6.1** | **5.7** | **4.8** | **4.4** | **3.3** | **2.5** | **2.5** | **6.1** | **4.5** |
| **Yucatán** | **Valladolid** | **3.7** | **4.1** | **3.1** | **5.4** | **5.7** | **5.3** | **5.4** | **5.4** | **4.9** | **4.2** | **3.8** | **3.5** | **3.1** | **5.7** | **4.5** |
| **Chiapas** | **San Cristóbal** | **4** | **4.3** | **4.5** | **4.5** | **4.8** | **4.7** | **5.4** | **5.3** | **4.6** | **4.2** | **3.9** | **3.7** | **3.7** | **5.4** | **4.5** |
| **Nuevo León** | **Monterrey** | **3.2** | **3.6** | **4.1** | **4.3** | **4.8** | **5.5** | **6.1** | **5.6** | **5** | **3.8** | **3.3** | **3** | **3** | **6.1** | **4.4** |
| **Veracruz** | **Tuxpan** | **3.1** | **3.8** | **4.4** | **4.8** | **4.7** | **4.4** | **4.7** | **5.5** | **4.4** | **4.1** | **3.4** | **3.1** | **3.1** | **5.5** | **4.2** |
| **Veracruz** | **Jalapa** | **3.2** | **3.5** | **3.8** | **4.3** | **4.6** | **4.4** | **4.9** | **5** | **4.4** | **3.7** | **3.3** | **3** | **3** | **5** | **4** |
| **Veracruz** | **Orizaba** | **3.3** | **3.5** | **3.9** | **4.2** | **4.9** | **4.4** | **4.5** | **4.6** | **4.3** | **3.6** | **3.3** | **3.1** | **3.1** | **4.9** | **4** |
| **Veracruz** | **Córdoba** | **3.1** | **3.3** | **3.6** | **3.8** | **4.1** | **4.4** | **4.6** | **4.5** | **4.1** | **3.5** | **3.1** | **2.8** | **2.8** | **4.6** | **3.7** |