## Appendix 1

Table 4 Readings and results of May 2018

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Angle$$(°)$$ | SolarIntensity(W/m2) | FrontSurfaceTemperature ofpanel$$(℃)$$ | BackSurfaceTemperature ofpanel$$(℃)$$ | Efficiency(%) | MassFlowRate of PV panel$$(\frac{Ltr.}{min.})$$ | AfterCoolingFrontSurfaceTemperature ofpanel$$(℃)$$ | AfterCoolingBackSurfaceTemperature ofpanel$$(℃)$$ | AfterCoolingEfficiency(%) | InletTemperatureOf waterIn panel$$(℃)$$ | OutletTemperatureOf waterIn solarcollector$$(℃)$$ | MassFlowRate of Collector$$(\frac{Ltr.}{min.})$$ | Collector efficiency(%) | Overall efficiency(%) |
| 0 | 720 | 49.5 | 52.8 | 14.22 | 0.5 | 31.2 | 33.9 | 14.9 | 28 | 60 | 0.375 | 51.8 | 66.7 |
| 760 | 44 | 47 | 15.33 | 1 | 31 | 32 | 15.83 | 29 | 45 | 0.875 | 49.08 | 64.91 |
| 720 | 45 | 48 | 14.53 | 1.5 | 30 | 32 | 15.05 | 29 | 41 | 1.375 | 47.47 | 62.52 |
| 700 | 43 | 45 | 14.7 | 2 | 28 | 31 | 15.3 | 29.3 | 38 | 1.875 | 48.44 | 63.74 |
| 25 | 700 | 40 | 45 | 13.93 | 0.5 | 32 | 35.5 | 15.25 | 28.6 | 58.5 | 0.375 | 60.84 | 76.09 |
| 835 | 43.2 | 47.4 | 14.96 | 1 | 28 | 34.5 | 16.6 | 28.1 | 50 | 0.875 | 57.55 | 74.15 |
| 840 | 44 | 46 | 15 | 1.5 | 27 | 31 | 16.2 | 29 | 46 | 1.375 | 56.66 | 72.86 |
| 800 | 41 | 46 | 14.56 | 2 | 27.3 | 32 | 16.4 | 31 | 42 | 1.875 | 54.65 | 71.05 |
| 45 | 710 | 42 | 47 | 14.08 | 0.5 | 34 | 37 | 14.35 | 29.5 | 59 | 0.375 | 59.01 | 53.36 |
| 460 | 44 | 47.3 | 12.71 | 1 | 29.9 | 33.6 | 14.74 | 32.5 | 46 | 0.875 | 64.40 | 79.14 |
| 520 | 43 | 47 | 14.2 | 1.5 | 28.6 | 32.5 | 14.9 | 32 | 42 | 1.375 | 66.31 | 81.21 |
| 630 | 40 | 45 | 14 | 2 | 27.4 | 30.3 | 15.3 | 32 | 40 | 1.875 | 59.71 | 75.01 |
| 75 | 720 | 43.3 | 48.2 | 12 | 0.5 | 28.2 | 32.8 | 13.8 | 29 | 62 | 0.375 | 58.1 | 71.90 |
| 840 | 40 | 42 | 11.5 | 1 | 27.9 | 31 | 12.83 | 33.7 | 55 | 0.875 | 55.64 | 68.43 |
| 800 | 47 | 49 | 11.2 | 1.5 | 28 | 30 | 12.4 | 34 | 50 | 1.375 | 64.15 | 76.5 |
| 790 | 41 | 46 | 11.67 | 2 | 29.4 | 30.3 | 12.2 | 34 | 44 | 1.875 | 55.52 | 67.7 |

## Appendix 2

Table 5Readings and results of July 2018

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Angle$$(°)$$ | SolarIntensity(W/m2) | FrontSurface Temperature ofpanel$$(℃)$$ | BackSurfaceTemperature ofpanel$$(℃)$$ | Efficiency(%) | MassFlowRate of PV panel$$(\frac{Ltr.}{min.})$$ | AfterCoolingFrontSurfaceTemperature ofpanel$$(℃)$$ | AfterCoolingBackSurfaceTemper-ature ofpanel$$(℃)$$ | AfterCoolingEfficiency(%) | InletTemperatureOf waterIn panel$$(℃)$$ | OutletTemperatureOf waterIn solarcollector$$(℃)$$ | MassFlowRate of Collector$(\frac{Ltr.}{min.}$) | Collector efficiency(%) | Overall efficiency(%) |
| 0 | 580 | 40 | 41 | 14.08 | 0.5 | 32.7 | 35.8 | 15.41 | 29 | 62 | 0.375 | 53.51 | 68.92 |
| 885 | 41 | 46 | 14.54 | 1 | 34 | 37 | 15.27 | 30 | 54 | 0.875 | 59.51 | 74.78 |
| 800 | 42 | 46 | 14.3 | 1.5 | 34.5 | 36 | 15.05 | 30 | 45 | 1.375 | 64.65 | 79.7 |
| 920 | 42 | 45.5 | 14.4 | 2 | 33 | 35 | 15.1 | 30 | 42 | 1.875 | 61.33 | 76.43 |
| 25 | 600 | 42 | 47.5 | 14.45 | 0.5 | 34.6 | 42.6 | 15 | 30 | 60 | 0.375 | 57.02 | 72.02 |
| 805 | 42 | 47.3 | 14.60 | 1 | 32 | 40 | 14.9 | 30.5 | 54 | 0.875 | 64.06 | 78.96 |
| 880 | 42.6 | 47.8 | 14.7 | 1.5 | 31 | 38 | 15.3 | 30.5 | 46 | 1.375 | 60.74 | 76.04 |
| 900 | 41 | 46 | 14.2 | 2 | 32 | 35 | 14.8 | 31 | 43 | 1.875 | 58.70 | 74.5 |
| 45 | 650 | 41.5 | 47.1 | 14.41 | 0.5 | 32.5 | 39.5 | 14.88 | 31 | 62 | 0.375 | 58.85 | 73.73 |
| 920 | 41.2 | 45.2 | 14.18 | 1 | 32.3 | 35 | 16.01 | 31.5 | 60 | 0.875 | 67.98 | 83.99 |
| 950 | 42 | 47 | 14 | 1.5 | 32 | 34 | 15.2 | 31 | 48 | 1.375 | 61.71 | 76.91 |
| 800 | 41 | 45 | 13.9 | 2 | 31 | 36 | 14.7 | 31.5 | 42 | 1.875 | 61.72 | 76.42 |
| 75 | 700 | 44.2 | 48.3 | 12.54 | 0.5 | 37 | 40 | 15.49 | 31.5 | 65 | 0.375 | 55.01 | 70.5 |
| 820 | 42 | 44.6 | 13 | 1 | 34 | 37.2 | 13.2 | 31.5 | 55 | 0.875 | 54.86 | 68.06 |
| 830 | 43 | 46.3 | 12.87 | 1.5 | 36 | 38.3 | 13.2 | 32 | 47 | 1.375 | 60.32 | 73.52 |
| 820 | 41 | 45 | 13.1 | 2 | 34 | 35.7 | 13.6 | 32 | 43 | 1.875 | 58.08 | 71.68 |

## Appendix 3

Table 6 Readings of October 2018

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Angle(deg) | Intensity(W/m2) | Front panel temperature(without cooling) | Back panel temperature(without cooling) | Efficiency(%) | Mass flow rate(Liters/minute) | Front panel temperature(with cooling) (oC) | Back panel temperature(with cooling) (oC) | Efficiency(%) | Collector inlet temperature(oC) | Collector outlet temperature(oC) | Collector efficiency(%) | Overall efficiency(%) |
| 10 | 700 | 48 | 50 | 16.9 | 0.5 | 30 | 35 | 17.3 | 30 | 58 | 54 | 71.3 |
| 650 | 46 | 49 | 17 | 1 | 29 | 34 | 17.6 | 30 | 57 | 56 | 73.6 |
| 690 | 46 | 52 | 16.2 | 1.5 | 29 | 34 | 17.8 | 32 | 52 | 56.7 | 74.5 |
| 800 | 47 | 50 | 15.7 | 2 | 27 | 30 | 17.2 | 32 | 48 | 54 | 71.2 |
| 25 | 710 | 49 | 51 | 17.1 | 0.5 | 30.5 | 33 | 17.9 | 32 | 56 | 54.7 | 72.6 |
| 680 | 49.5 | 52 | 17.3 | 1 | 31 | 34 | 17.8 | 32.5 | 55 | 55.7 | 73.5 |
| 700 | 48.5 | 51 | 16.7 | 1.5 | 32 | 35 | 17.6 | 32 | 53.5 | 61 | 78.6 |
| 740 | 49 | 53 | 17 | 2 | 31 | 34.5 | 18 | 32 | 50 | 52 | 70 |
| 45 | 710 | 48.3 | 51 | 17.01 | 0.5 | 30 | 35 | 18.5 | 30 | 58 | 53.2 | 70.2 |
| 636 | 45 | 49.5 | 17.5 | 1 | 29.5 | 34 | 18 | 31 | 56 | 58.67 | 76.17 |
| 671 | 45.5 | 51.5 | 17 | 1.5 | 29 | 34 | 17.52 | 32 | 50 | 59 | 76 |
| 770 | 47 | 49.5 | 16.5 | 2 | 25 | 26 | 17.45 | 32 | 48 | 55 | 71.5 |
| 75 | 700 | 49.3 | 50 | 15.5 | 0.5 | 30.2 | 34 | 16.5 | 31.4 | 58.4 | 53.5 | 70 |
| 630 | 47.5 | 50.5 | 15.9 | 1 | 28.7 | 34.7 | 16.4 | 32 | 55 | 58 | 74.4 |
| 690 | 45 | 51.5 | 16.3 | 1.5 | 29.8 | 32.9 | 17.01 | 33.3 | 48.5 | 58.3 | 75.3 |
| 800 | 46.2 | 48.4 | 16.1 | 2 | 26 | 26.3 | 17.1 | 34 | 46 | 52 | 69.1 |