

Vedlegg 4: Resultatutskrift fra PVGIS

Vedlegg 4.1: 330W paneler, Bergen

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

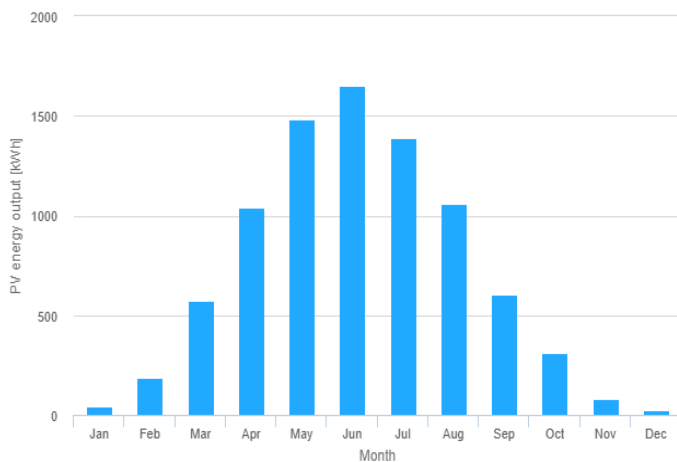
Provided inputs:

Latitude/Longitude: 60.394, 5.325
Horizon: None
Database used: PVGIS-SARAH
PV technology: Crystalline silicon
PV installed: 13.86 kWp
System loss: 14 %

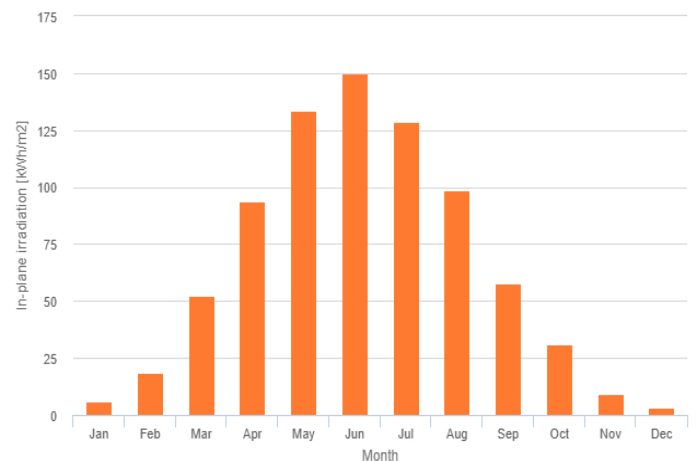
Simulation outputs

Slope angle: 27 °
Azimuth angle: 90 °
Yearly PV energy production: 8445.52 kWh
Yearly in-plane irradiation: 783.12 kWh/m²
Year-to-year variability: 559.77 kWh
Changes in output due to:
Angle of incidence: -4.27 %
Spectral effects: NaN %
Temperature and low irradiance: -5.49 %
Total loss: -22.19 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 46.5 | 5.8 | 17.8 |
| February | 186.8 | 18.7 | 60.7 |
| March | 572.6 | 52.5 | 132.3 |
| April | 1043.1 | 93.8 | 77.8 |
| May | 1480.2 | 133.5 | 254.7 |
| June | 1648.3 | 150.0 | 247.8 |
| July | 1388.7 | 128.9 | 176.5 |
| August | 1057.0 | 98.8 | 89.2 |
| September | 607.0 | 57.5 | 123.8 |
| October | 311.9 | 30.9 | 61.8 |
| November | 81.3 | 9.4 | 19.8 |
| December | 22.0 | 3.3 | 7.7 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.2: 330W paneler, Kristiansand

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

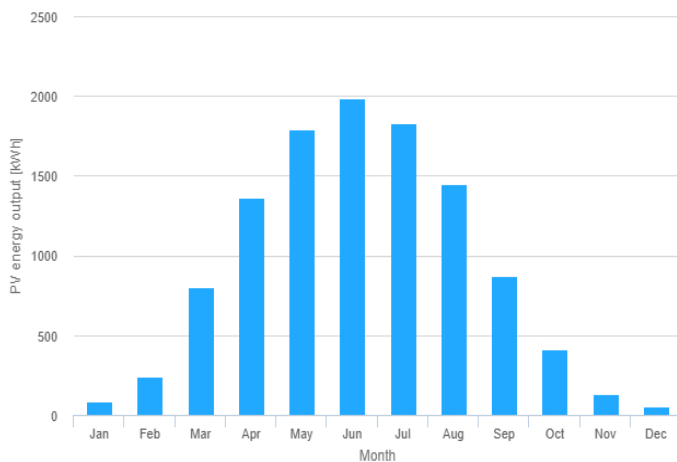
Provided inputs:

Latitude/Longitude: 58.147, 7.995
 Horizon: None
 Database used: PVGIS-SARAH
 PV technology: Crystalline silicon
 PV installed: 13.86 kWp
 System loss: 14 %

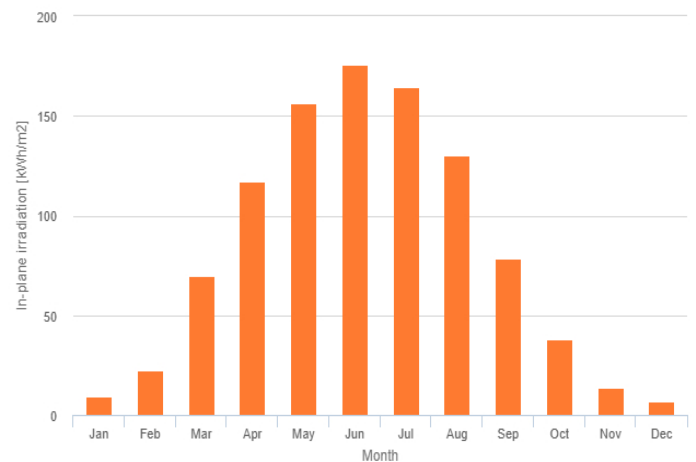
Simulation outputs

Slope angle: 27 °
 Azimuth angle: 90 °
 Yearly PV energy production: 11011.57 kWh
 Yearly in-plane irradiation: 983.21 kWh/m²
 Year-to-year variability: 727.89 kWh
 Changes in output due to:
 Angle of incidence: -4.04 %
 Spectral effects: 1.23 %
 Temperature and low irradiance: -3.27 %
 Total loss: -19.19 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 86.9 | 9.6 | 27.6 |
| February | 238.4 | 22.6 | 54.9 |
| March | 804.4 | 69.8 | 80.8 |
| April | 1362.0 | 117.4 | 131.5 |
| May | 1793.2 | 156.2 | 226.6 |
| June | 1984.0 | 175.9 | 229.2 |
| July | 1828.9 | 164.7 | 242.8 |
| August | 1449.0 | 130.2 | 133.7 |
| September | 869.8 | 78.3 | 115.6 |
| October | 410.0 | 38.1 | 63.0 |
| November | 133.3 | 14.0 | 40.2 |
| December | 51.7 | 6.6 | 12.3 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.3: 330W paneler, Oslo

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

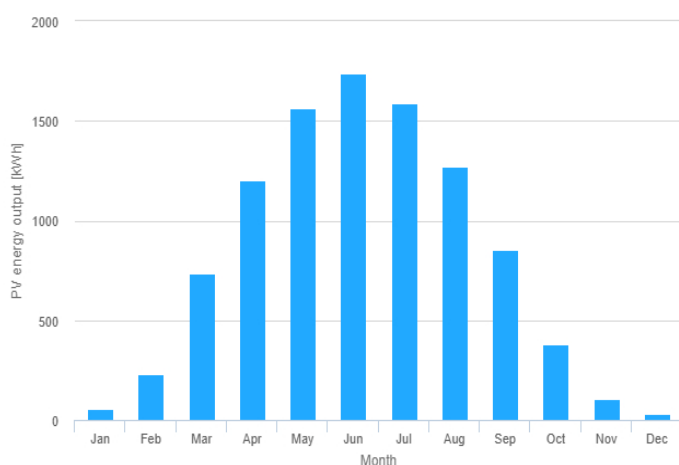
Provided inputs:

Latitude/Longitude: 59.913, 10.739
Horizon: None
Database used: PVGIS-SARAH
PV technology: Crystalline silicon
PV installed: 13.86 kWp
System loss: 14 %

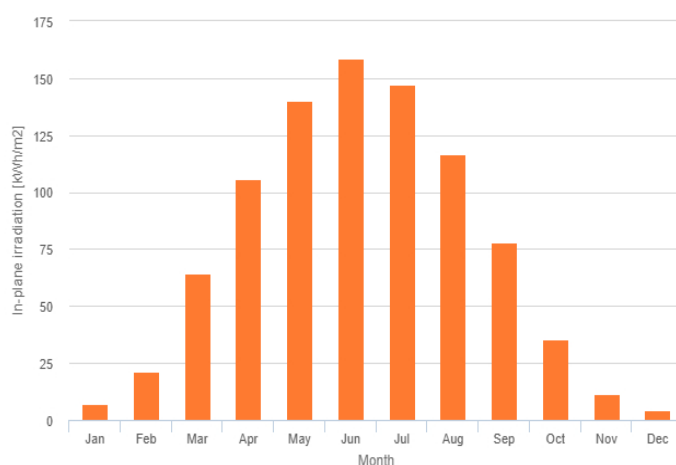
Simulation outputs

Slope angle: 27 °
Azimuth angle: 90 °
Yearly PV energy production: 9753.81 kWh
Yearly in-plane irradiation: 890.73 kWh/m²
Year-to-year variability: 264.11 kWh
Changes in output due to:
Angle of incidence: -4.29 %
Spectral effects: 1.52 %
Temperature and low irradiance: -5.45 %
Total loss: -20.99 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 58.6 | 7.0 | 17.1 |
| February | 229.7 | 21.4 | 62.2 |
| March | 732.4 | 64.4 | 93.1 |
| April | 1199.5 | 105.9 | 164.8 |
| May | 1564.8 | 140.3 | 179.6 |
| June | 1736.9 | 158.4 | 121.6 |
| July | 1587.1 | 147.2 | 206.8 |
| August | 1270.4 | 116.6 | 95.9 |
| September | 856.2 | 78.1 | 94.1 |
| October | 377.5 | 35.4 | 57.6 |
| November | 107.6 | 11.5 | 31.8 |
| December | 33.3 | 4.6 | 9.1 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.4: 330W paneler, Tromsø

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

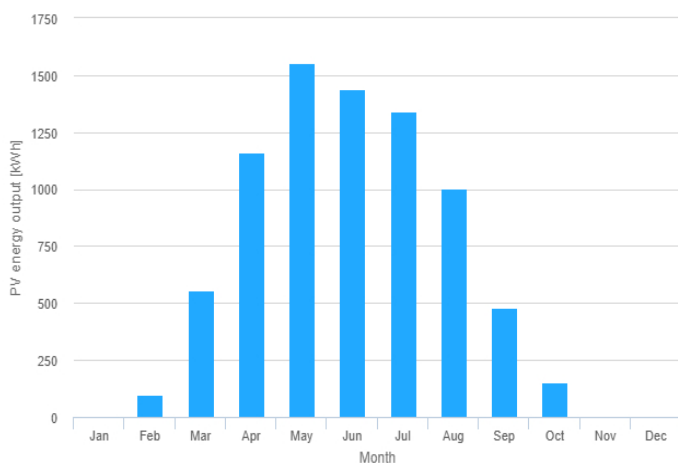
Provided inputs:

Latitude/Longitude: 69.649, 18.955
 Horizon: None
 Database used: PVGIS-ERA5
 PV technology: Crystalline silicon
 PV installed: 13.86 kWp
 System loss: 14 %

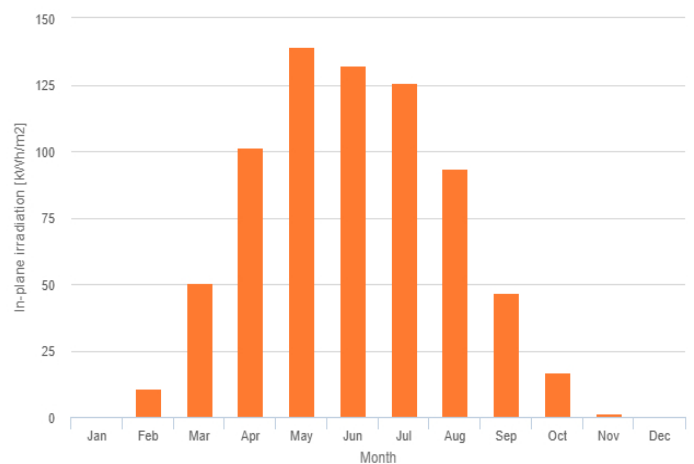
Simulation outputs

Slope angle: 27 °
 Azimuth angle: 90 °
 Yearly PV energy production: 7797.37 kWh
 Yearly in-plane irradiation: 718.37 kWh/m²
 Year-to-year variability: 364.57 kWh
 Changes in output due to:
 Angle of incidence: -4.7 %
 Spectral effects: NaN %
 Temperature and low irradiance: -4.45 %
 Total loss: -21.69 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 0.8 | 0.3 | 0.3 |
| February | 97.2 | 10.7 | 14.5 |
| March | 558.7 | 50.6 | 77.5 |
| April | 1158.5 | 101.6 | 138.4 |
| May | 1556.4 | 139.4 | 138.4 |
| June | 1440.5 | 132.1 | 204.7 |
| July | 1343.5 | 125.5 | 191.9 |
| August | 1000.8 | 93.7 | 108.4 |
| September | 480.0 | 46.5 | 68.4 |
| October | 153.6 | 16.6 | 35.8 |
| November | 7.4 | 1.4 | 2.4 |
| December | 0.0 | 0.0 | 0.0 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.5: 330W paneler, Trondheim

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

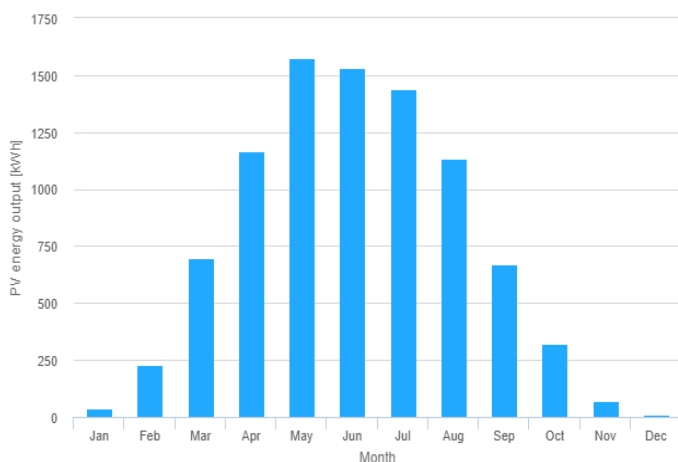
Provided inputs:

Latitude/Longitude: 63.431, 10.395
Horizon: None
Database used: PVGIS-ERA5
PV technology: Crystalline silicon
PV installed: 13.86 kWp
System loss: 14 %

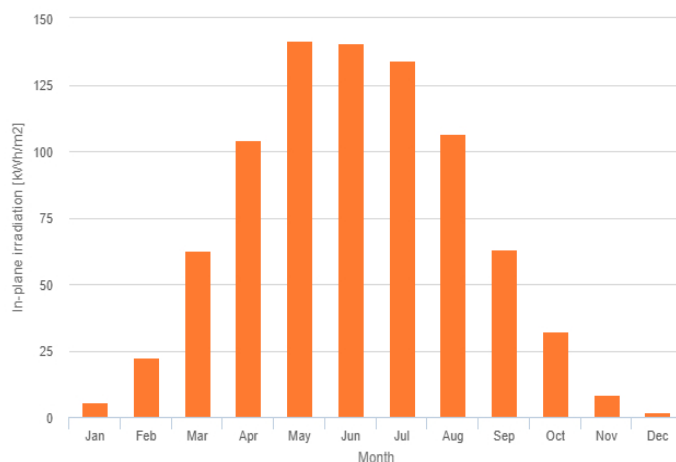
Simulation outputs

Slope angle: 27 °
Azimuth angle: 90 °
Yearly PV energy production: 8881.1 kWh
Yearly in-plane irradiation: 823.31 kWh/m²
Year-to-year variability: 425.80 kWh
Changes in output due to:
Angle of incidence: -4.55 %
Spectral effects: NaN %
Temperature and low irradiance: -5.19 %
Total loss: -22.17 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 39.1 | 5.4 | 10.7 |
| February | 226.5 | 22.4 | 34.9 |
| March | 695.5 | 62.8 | 127.2 |
| April | 1167.2 | 104.0 | 109.7 |
| May | 1574.3 | 141.7 | 93.3 |
| June | 1533.7 | 140.4 | 173.7 |
| July | 1440.2 | 134.3 | 204.8 |
| August | 1136.4 | 106.4 | 109.8 |
| September | 668.3 | 63.3 | 82.0 |
| October | 321.1 | 32.0 | 55.4 |
| November | 69.6 | 8.6 | 12.3 |
| December | 9.2 | 1.9 | 2.4 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.6: 370W paneler, Bergen

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

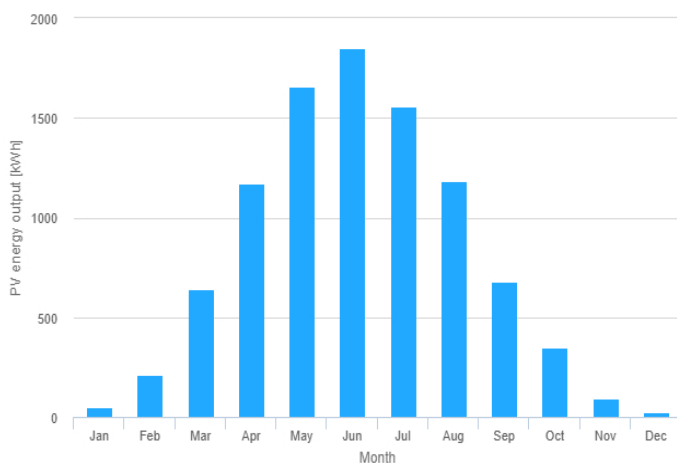
Provided inputs:

Latitude/Longitude: 60.394, 5.325
Horizon: None
Database used: PVGIS-SARAH
PV technology: Crystalline silicon
PV installed: 15.54 kWp
System loss: 14 %

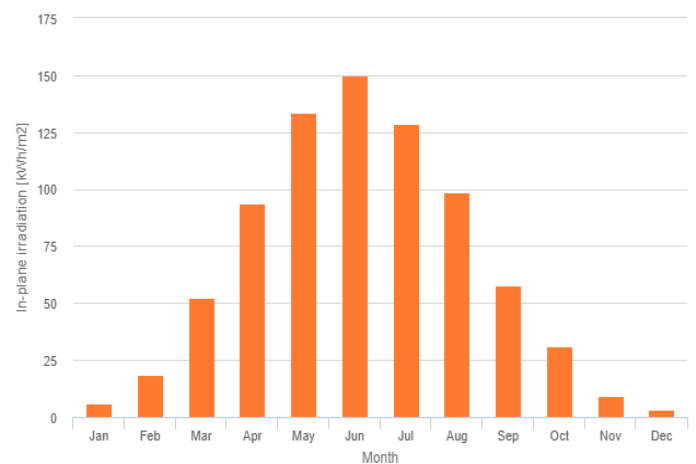
Simulation outputs

Slope angle: 27 °
Azimuth angle: 90 °
Yearly PV energy production: 9469.22 kWh
Yearly in-plane irradiation: 783.12 kWh/m²
Year-to-year variability: 627.62 kWh
Changes in output due to:
Angle of incidence: -4.27 %
Spectral effects: NaN %
Temperature and low irradiance: -5.49 %
Total loss: -22.19 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 52.2 | 5.8 | 20.0 |
| February | 209.5 | 18.7 | 68.0 |
| March | 642.0 | 52.5 | 148.4 |
| April | 1169.5 | 93.8 | 87.3 |
| May | 1659.6 | 133.5 | 285.6 |
| June | 1848.1 | 150.0 | 277.8 |
| July | 1557.1 | 128.9 | 197.9 |
| August | 1185.1 | 98.8 | 100.0 |
| September | 680.6 | 57.5 | 138.8 |
| October | 349.7 | 30.9 | 69.3 |
| November | 91.2 | 9.4 | 22.3 |
| December | 24.7 | 3.3 | 8.7 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.7: 370W paneler, Kristiansand

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

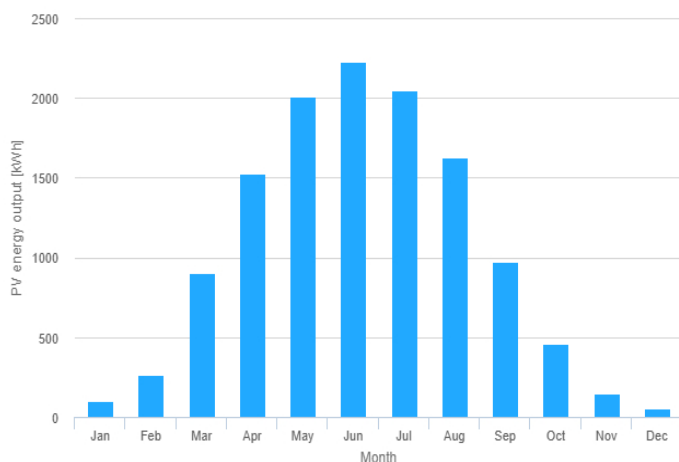
Provided inputs:

Latitude/Longitude: 58.147, 7.995
 Horizon: None
 Database used: PVGIS-SARAH
 PV technology: Crystalline silicon
 PV installed: 15.54 kWp
 System loss: 14 %

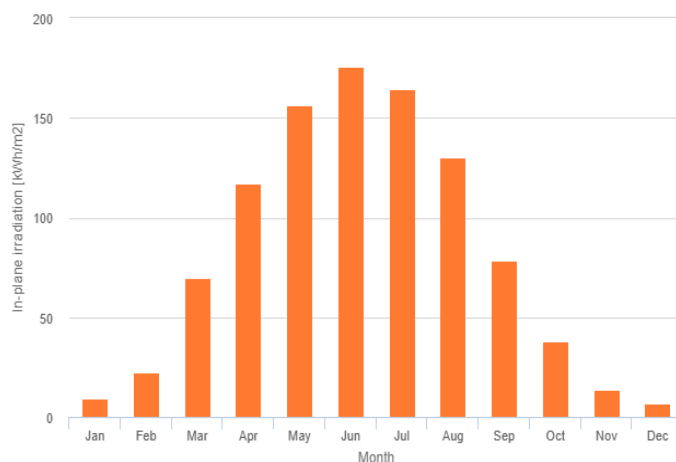
Simulation outputs

Slope angle: 27 °
 Azimuth angle: 90 °
 Yearly PV energy production: 12346.31 kWh
 Yearly in-plane irradiation: 983.21 kWh/m²
 Year-to-year variability: 816.12 kWh
 Changes in output due to:
 Angle of incidence: -4.04 %
 Spectral effects: 1.23 %
 Temperature and low irradiance: -3.27 %
 Total loss: -19.19 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 97.4 | 9.6 | 30.9 |
| February | 267.3 | 22.6 | 61.6 |
| March | 901.9 | 69.8 | 90.6 |
| April | 1527.1 | 117.4 | 147.5 |
| May | 2010.6 | 156.2 | 254.0 |
| June | 2224.5 | 175.9 | 256.9 |
| July | 2050.6 | 164.7 | 272.3 |
| August | 1624.6 | 130.2 | 149.9 |
| September | 975.2 | 78.3 | 129.6 |
| October | 459.7 | 38.1 | 70.6 |
| November | 149.5 | 14.0 | 45.1 |
| December | 57.9 | 6.6 | 13.8 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.8: 370W paneler, Oslo

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

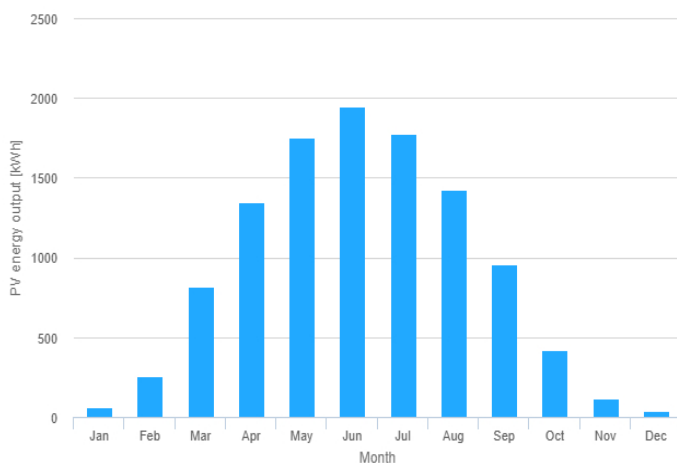
Provided inputs:

Latitude/Longitude: 59.913, 10.739
 Horizon: None
 Database used: PVGIS-SARAH
 PV technology: Crystalline silicon
 PV installed: 15.54 kWp
 System loss: 14 %

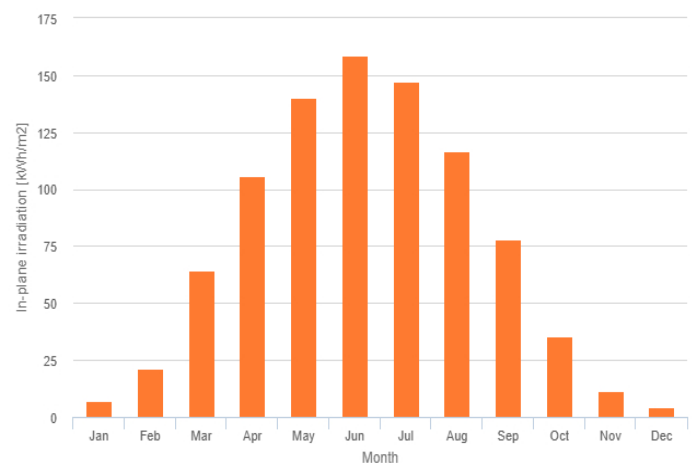
Simulation outputs

Slope angle: 27 °
 Azimuth angle: 90 °
 Yearly PV energy production: 10936.09 kWh
 Yearly in-plane irradiation: 890.73 kWh/m²
 Year-to-year variability: 296.12 kWh
 Changes in output due to:
 Angle of incidence: -4.29 %
 Spectral effects: 1.52 %
 Temperature and low irradiance: -5.45 %
 Total loss: -20.99 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 65.7 | 7.0 | 19.1 |
| February | 257.5 | 21.4 | 69.8 |
| March | 821.2 | 64.4 | 104.4 |
| April | 1344.8 | 105.9 | 184.8 |
| May | 1754.4 | 140.3 | 201.4 |
| June | 1947.4 | 158.4 | 136.3 |
| July | 1779.5 | 147.2 | 231.9 |
| August | 1424.3 | 116.6 | 107.6 |
| September | 960.0 | 78.1 | 105.5 |
| October | 423.2 | 35.4 | 64.6 |
| November | 120.6 | 11.5 | 35.6 |
| December | 37.4 | 4.6 | 10.2 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.9: 370W paneler, Tromsø

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

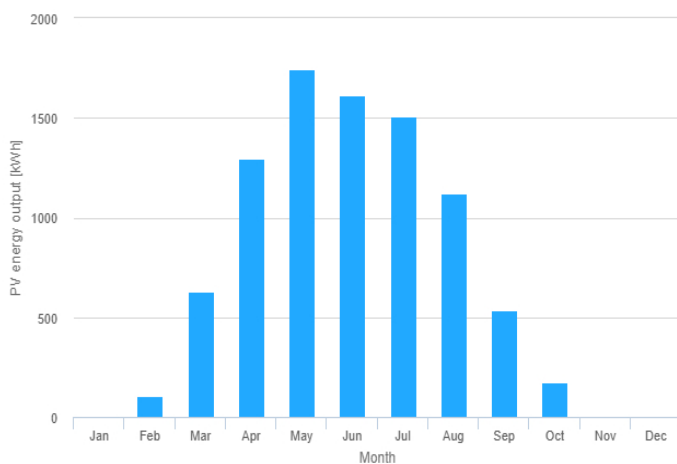
Provided inputs:

Latitude/Longitude: 69.649, 18.955
Horizon: None
Database used: PVGIS-ERA5
PV technology: Crystalline silicon
PV installed: 15.54 kWp
System loss: 14 %

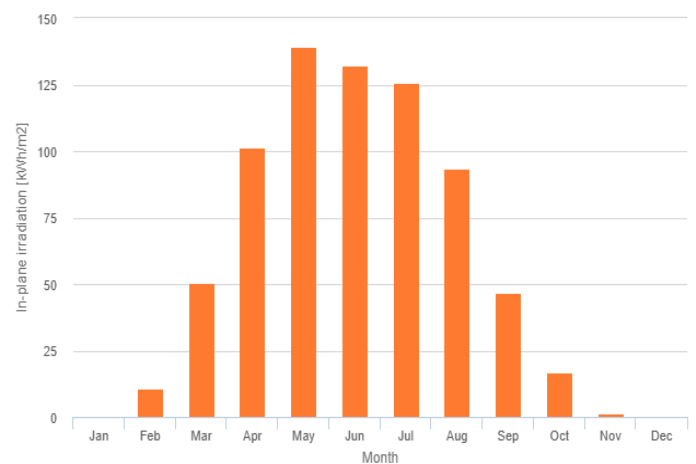
Simulation outputs

Slope angle: 27 °
Azimuth angle: 90 °
Yearly PV energy production: 8742.51 kWh
Yearly in-plane irradiation: 718.37 kWh/m²
Year-to-year variability: 408.76 kWh
Changes in output due to:
Angle of incidence: -4.7 %
Spectral effects: NaN %
Temperature and low irradiance: -4.45 %
Total loss: -21.69 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 0.9 | 0.3 | 0.3 |
| February | 109.0 | 10.7 | 16.3 |
| March | 626.4 | 50.6 | 86.9 |
| April | 1298.9 | 101.6 | 155.2 |
| May | 1745.1 | 139.4 | 155.2 |
| June | 1615.1 | 132.1 | 229.5 |
| July | 1506.4 | 125.5 | 215.2 |
| August | 1122.1 | 93.7 | 121.5 |
| September | 538.2 | 46.5 | 76.7 |
| October | 172.2 | 16.6 | 40.1 |
| November | 8.3 | 1.4 | 2.7 |
| December | 0.0 | 0.0 | 0.0 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].

Vedlegg 4.10: 370W paneler, Trondheim

Performance of grid-connected PV

PVGIS-5 estimates of solar electricity generation:

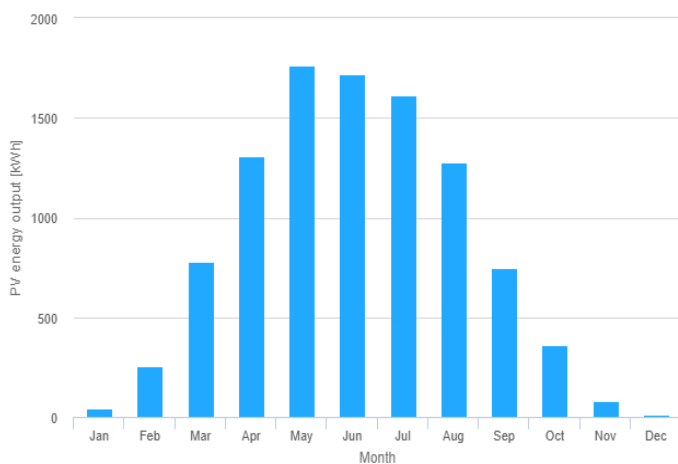
Provided inputs:

Latitude/Longitude: 63.431, 10.395
Horizon: None
Database used: PVGIS-ERA5
PV technology: Crystalline silicon
PV installed: 15.54 kWp
System loss: 14 %

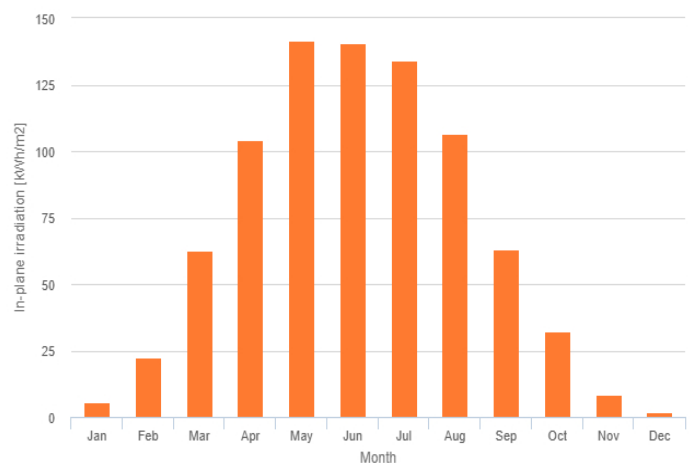
Simulation outputs

Slope angle: 27 °
Azimuth angle: 90 °
Yearly PV energy production: 9957.59 kWh
Yearly in-plane irradiation: 823.31 kWh/m²
Year-to-year variability: 477.41 kWh
Changes in output due to:
Angle of incidence: -4.55 %
Spectral effects: NaN %
Temperature and low irradiance: -5.19 %
Total loss: -22.17 %

Monthly energy output from fix-angle PV system:



Monthly in-plane irradiation for fixed-angle:



Monthly PV energy and solar irradiation

| Month | E_m | H(i)_m | SD_m |
|-----------|--------|--------|-------|
| January | 43.8 | 5.4 | 12.0 |
| February | 253.9 | 22.4 | 39.1 |
| March | 779.8 | 62.8 | 142.6 |
| April | 1308.7 | 104.0 | 123.0 |
| May | 1765.1 | 141.7 | 104.7 |
| June | 1719.6 | 140.4 | 194.8 |
| July | 1614.7 | 134.3 | 229.7 |
| August | 1274.2 | 106.4 | 123.1 |
| September | 749.3 | 63.3 | 91.9 |
| October | 360.0 | 32.0 | 62.2 |
| November | 78.0 | 8.6 | 13.7 |
| December | 10.3 | 1.9 | 2.7 |

E_m: Average monthly electricity production from the given system [kWh].

H(i)_m: Average monthly sum of global irradiation per square meter received by the modules of the given system [kWh/m²].

SD_m: Standard deviation of the monthly electricity production due to year-to-year variation [kWh].