Stand Alone System: Simulation parameters

**Project:** LOW off grid cottage

**Geographical Site:** Ottawa

**Situation:**
- Latitude: 45.2° N
- Longitude: 76.0° W
- Time defined as: Legal Time
- Time zone: UT-5
- Altitude: 100 m

<table>
<thead>
<tr>
<th>Month</th>
<th>Albedo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan.</td>
<td>0.80</td>
</tr>
<tr>
<td>Feb.</td>
<td>0.80</td>
</tr>
<tr>
<td>Mar.</td>
<td>0.40</td>
</tr>
<tr>
<td>Apr.</td>
<td>0.20</td>
</tr>
<tr>
<td>May</td>
<td>0.20</td>
</tr>
<tr>
<td>June</td>
<td>0.20</td>
</tr>
<tr>
<td>July</td>
<td>0.20</td>
</tr>
<tr>
<td>Aug.</td>
<td>0.20</td>
</tr>
<tr>
<td>Sep.</td>
<td>0.20</td>
</tr>
<tr>
<td>Oct.</td>
<td>0.20</td>
</tr>
<tr>
<td>Nov.</td>
<td>0.20</td>
</tr>
<tr>
<td>Dec.</td>
<td>0.60</td>
</tr>
</tbody>
</table>

**Meteo data:** Ottawa, Synthetic Hourly data

**Simulation variant:** Pole mount 12 module

**Simulation parameters**

**Coll. plane:** Seasonal tilt adjustment

- Azimuth: 0°
- Summer Tilt: 25°
- Winter Tilt: 60°

**Models used**

- Transposition
- Perez
- Diffuse
- Measured

**PV Array Characteristics**

**PV module**

- Si-poly
- Model: SW 235 Poly
- Manufacturer: SolarWorld
- In series: 3 modules
- In parallel: 4 strings
- Unit Nom. Power: 235 Wp
- At operating cond.: 2488 Wp (50°C)

**Array operating characteristics (50°C)**

- U mpp: 81 V
- I mp: 31 A

**Total area**

- Module area: 20.1 m²

**PV Array loss factors**

- Thermal Loss factor: Uc (const) 20.0 W/m²K
- Wiring Ohmic Loss: Global array res. 44 mOhm
- Array Soiling Losses: Loss Fraction 1.5 % at STC
- Module Quality Loss: Loss Fraction 5.0 %
- Module Mismatch Losses: Loss Fraction 1.5 %
- Incidence effect, ASHRAE parametrization: IAM = 1 - bo (1/cos i - 1)
- back Parameter 0.05

**System Parameter**

**System type:** Stand Alone System

**Battery**

- Model: PYX-2580L
- Manufacturer: Concorde
- Voltage: 48 V
- Nominal Capacity: 472 Ah
- Nb. of units: 4 in series x 2 in parallel

**Regulator**

- Model: FLEXmax 80 - 48V
- Manufacturer: Outback
- Technology: MPPT converter
- Temp coeff: -5.0 mV/°C/elem.

**Converter**

- Maxi and EURO efficiencies: 97.5%/96.3 %
- Charging: 54.7/52.3 V
- Discharging: 47.0/50.4 V
- Back-Up Genset Command: 47.3/51.6 V

**User's needs:** Daily household consumers Constant over the year average 6.6 kWh/Day
Stand Alone System: Detailed User's needs

**Project:** LOW off grid cottage  
**Simulation variant:** Pole mount 12 module

<table>
<thead>
<tr>
<th>Main system parameters</th>
<th>Stand alone</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Field Orientation</td>
<td>Seasonal tilt: summer/winter</td>
</tr>
<tr>
<td></td>
<td>25° / 60°</td>
</tr>
<tr>
<td>PV Array</td>
<td>Nb. of modules</td>
</tr>
<tr>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Battery</td>
<td>Model</td>
</tr>
<tr>
<td></td>
<td>PVX-2580L</td>
</tr>
<tr>
<td>Battery Pack</td>
<td>Nb. of units</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td>User's needs</td>
<td>Daily household consumers</td>
</tr>
<tr>
<td></td>
<td>Constant over the year</td>
</tr>
<tr>
<td></td>
<td>2427 kWh/year</td>
</tr>
</tbody>
</table>

**System type:** Stand alone  
**azimuth:** 0°  
**Pnom total:** 2820 Wp  
**Technology:** vented, vehicle starting  
**Voltage / Capacity:** 48 V / 472 Ah

**Battery**

**Model:** PVX-2580L  
**Technology:** vented, vehicle starting  
**Voltage / Capacity:** 48 V / 472 Ah

**User's needs**

- **Daily household consumers**, Constant over the year, average = 6.6 kWh/day

**Annual values**

<table>
<thead>
<tr>
<th>Use 2 days a week</th>
<th>Number</th>
<th>Power</th>
<th>Use</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other uses</td>
<td>1</td>
<td>130 W tot</td>
<td>24 h/day</td>
<td>3120 Wh/day</td>
</tr>
<tr>
<td>Stand-by consumers</td>
<td>1</td>
<td>240 W tot</td>
<td>24 h/day, 7days/7</td>
<td>5760 Wh/day</td>
</tr>
<tr>
<td>Total daily energy</td>
<td></td>
<td></td>
<td></td>
<td>8880 Wh/day</td>
</tr>
</tbody>
</table>

**Daily household consumers**

- **Number Power Use Energy**
  - **Other uses**
    - 1 130 W tot 24 h/day 3120 Wh/day
  - **Stand-by consumers**
    - 1 240 W tot 24 h/day, 7days/7 5760 Wh/day
  - **Total daily energy**
    - 8880 Wh/day
Stand Alone System: Main results

Project: LOW off grid cottage
Simulation variant: Pole mount 12 module

Main system parameters
- System type: Stand alone
- PV Field Orientation: Seasonal tilt: summer/winter 25° / 60°
- Azimuth: 0°
- PV Array: 12 modules
- Battery: Model PVX-2580L, Technology vented, vehicle starting
- Battery Pack: 8 units, Voltage / Capacity: 48 V / 472 Ah
- User’s needs: Constant over the year, global 2427 kWh/year

Main simulation results
- Available Energy: 3979 kWh/year
- Specific production: 1411 kWh/kWp/year
- Used Energy: 2345 kWh/year
- Excess (unused): 1453 kWh/year
- Performance Ratio PR: 47.9%
- Solar Fraction SF: 96.5%
- Loss of Load Time Fraction: 3.3%
- Missing Energy: 85 kWh/year

Balances and main results

<table>
<thead>
<tr>
<th></th>
<th>GlobHor</th>
<th>GlobEff</th>
<th>E Avail</th>
<th>E Unused</th>
<th>E Miss</th>
<th>E User</th>
<th>E Load</th>
<th>SolFrac</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>1379.0</td>
<td>1684.9</td>
<td>3978.8</td>
<td>1452.8</td>
<td>85.41</td>
<td>2344.6</td>
<td>2430.0</td>
<td>0.965</td>
</tr>
<tr>
<td>January</td>
<td>52.0</td>
<td>113.7</td>
<td>283.8</td>
<td>59.2</td>
<td>10.63</td>
<td>199.1</td>
<td>209.8</td>
<td>0.949</td>
</tr>
<tr>
<td>February</td>
<td>78.0</td>
<td>148.4</td>
<td>388.2</td>
<td>185.3</td>
<td>0.00</td>
<td>186.2</td>
<td>186.2</td>
<td>1.000</td>
</tr>
<tr>
<td>March</td>
<td>123.0</td>
<td>167.5</td>
<td>420.3</td>
<td>198.2</td>
<td>0.00</td>
<td>203.5</td>
<td>203.5</td>
<td>1.000</td>
</tr>
<tr>
<td>April</td>
<td>142.0</td>
<td>154.1</td>
<td>360.6</td>
<td>142.8</td>
<td>0.00</td>
<td>200.9</td>
<td>200.9</td>
<td>1.000</td>
</tr>
<tr>
<td>May</td>
<td>180.0</td>
<td>180.9</td>
<td>417.4</td>
<td>193.0</td>
<td>0.00</td>
<td>206.6</td>
<td>206.6</td>
<td>1.000</td>
</tr>
<tr>
<td>June</td>
<td>187.0</td>
<td>181.1</td>
<td>404.9</td>
<td>185.9</td>
<td>0.00</td>
<td>197.8</td>
<td>197.8</td>
<td>1.000</td>
</tr>
<tr>
<td>July</td>
<td>187.0</td>
<td>184.5</td>
<td>413.1</td>
<td>181.7</td>
<td>0.00</td>
<td>209.8</td>
<td>209.8</td>
<td>1.000</td>
</tr>
<tr>
<td>August</td>
<td>156.0</td>
<td>163.7</td>
<td>372.8</td>
<td>151.0</td>
<td>0.00</td>
<td>203.5</td>
<td>203.5</td>
<td>1.000</td>
</tr>
<tr>
<td>September</td>
<td>117.0</td>
<td>134.5</td>
<td>310.1</td>
<td>107.0</td>
<td>9.23</td>
<td>188.5</td>
<td>197.8</td>
<td>0.953</td>
</tr>
<tr>
<td>October</td>
<td>78.0</td>
<td>109.5</td>
<td>258.5</td>
<td>44.1</td>
<td>0.00</td>
<td>209.8</td>
<td>209.8</td>
<td>1.000</td>
</tr>
<tr>
<td>November</td>
<td>40.0</td>
<td>62.2</td>
<td>141.7</td>
<td>0.6</td>
<td>53.05</td>
<td>144.7</td>
<td>197.8</td>
<td>0.732</td>
</tr>
<tr>
<td>December</td>
<td>39.0</td>
<td>84.9</td>
<td>207.5</td>
<td>3.9</td>
<td>12.50</td>
<td>194.1</td>
<td>206.6</td>
<td>0.939</td>
</tr>
</tbody>
</table>

Legends:
- GlobHor: Horizontal global irradiation
- GlobEff: Effective Global, corr. for IAM and shadings
- E Avail: Available Solar Energy
- E Unused: Unused energy (full battery)
- E Miss: Missing energy
- E User: Energy supplied to the user
- E Load: Energy need of the user (Load)
- SolFrac: Solar fraction (EUsed / ELoad)
Stand Alone System: Loss diagram

**Project:** LOW off grid cottage  
**Simulation variant:** Pole mount 12 module

<table>
<thead>
<tr>
<th>Main system parameters</th>
<th>System type</th>
<th>Seasonal tilt: summer/winter 25° / 60°</th>
<th>azimuth 0°</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV Field Orientation</td>
<td>Nb. of modules 12</td>
<td>Pnom total 2820 Wp</td>
<td></td>
</tr>
<tr>
<td>Battery</td>
<td>Model PVX-2580L</td>
<td>Technology vented, vehicle starting</td>
<td></td>
</tr>
<tr>
<td>Battery Pack</td>
<td>Nb. of units 8</td>
<td>Voltage / Capacity 48 V / 472 Ah</td>
<td></td>
</tr>
<tr>
<td>User's needs</td>
<td>Daily household consumers</td>
<td>Constant over the year global</td>
<td></td>
</tr>
</tbody>
</table>

**Loss diagram over the whole year**

- Horizontal global irradiation
- Global incident in coll. plane
- IAM factor on global
- Effective irradiance on collectors
- PV conversion
- Array nominal energy (at STC effic.)
- PV loss due to irradiance level
- PV loss due to temperature
- Array Soiling loss
- Module quality loss
- Module array mismatch loss
- Ohmic wiring loss
- Loss by respect to the MPP running
- Unused energy (full battery) loss

**Effective energy at the output of the array**

- Converter Loss during operation (efficiency)
- Converter Loss due to power threshold
- Converter Loss over nominal conv. voltage
- Converter Loss due to voltage threshold

**Converter losses (effic, overload)**

- Battery Storage
- Battery Stored Energy balance
- Battery efficiency loss
- Gassing Current (electrolyte dissociation)
- Battery Self-discharge Current

**Energy supplied to the user**

**Energy need of the user (Load)**