```
For[tMin = 70;
 tPrimeMin = tMin;
 ac = Input["Please input the area of the collector in meters squared."];
 ϵL = .7;
 mDotCpMin = 3400 * 31 * 12 * 3600;
 cL = ϵL mDotCpMin;
 d = 15 000 * 31 * 12 * 3600;
 ms = 100;
 cp = 4190;
 h = -4.002;
 k = 4.702;
 tenv = 21;
 uas = 6;
 deltat = 31 * 12 * 3600;
 b = 3.85;
 c = -0.15;
 dd = -1.959;
 frPrimeUc = 3.5;
 hBar = 19.16 * 1 000 000;
 frPrimeταBar = 0.72 * 0.94;
 n = 31;
 kT = 0.480;
 capitalA = 7.10 - 20.00 kT + 12.08 kT^2;
 capitalB = -8.02 + 18.16 kT - 10.68 kT^2;
 capitalC = -1.02 + 4.10 kT - 1.96 kT^2;
 hdbyh = 1.317 - 3.023 kT + 3.372 kT^2 - 1.769 kT^3;
 frPrimeταn = 0.72;
 ρg = 0.2;
 s = 39.8;
 ll = 39.8;
 tambPrime = 16.8;
 z = d / cL;
 δ = 23.45 Sin[360/365 (284 + 135) Degree];
 a = 0.015 ((ms * cp/1000)/350)^-0.76;
 g = 0.2136 ((ms * cp/1000)/350)^-0.704;
 f1 = ((ϵL (mDotCpMin)) (tPrimeMin - tMin))/d;

 x = ac frPrimeUc (deltat/d);
 qu = qMax - a (Exp[b f1] - 1) (1 - Exp[c x]) (Exp[dd z]) * d;
 hs = ArcCos[-Tan[ll Degree] Tan[δ Degree]];
```

$$\text{smallrdn} = \frac{\text{Pi}}{24}\left(\frac{1-\text{Cos[hs Degree]}}{\text{Sin[hs Degree]} - \left(\frac{\text{Pi}}{180}\right)\text{hs Degree Cos[hs Degree]}}\right);$$

$$\text{smallrn} = \text{smallrdn}\left(1.07 + .025\,\text{Sin[hs Degree} - 60\,\text{Degree}]\right);$$

$$\text{rB} = (\text{Cos}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Cos}[\delta\,\text{Degree}] * \text{Cos}[\text{hs Degree}] + \text{Sin}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Sin}[\delta\,\text{Degree}]) / (\text{Cos}[\text{ll Degree}]\,\text{Cos}[\delta\,\text{Degree}] * \text{Cos}[\text{hs Degree}] + \text{Sin}[\text{ll Degree}]\,\text{Sin}[\delta\,\text{Degree}]);$$

$$\text{r} = \left(1 - \text{hdbyh}\right)\text{rB} + \text{hdbyh}\left(\frac{1+\text{Cos[s Degree]}}{2}\right) + \rho g\left(\frac{1-\text{Cos[s Degree]}}{2}\right);$$

$$\text{rBn} = (\text{Cos}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Cos}[\delta\,\text{Degree}] + \text{Sin}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Sin}[\delta\,\text{Degree}]) / (\text{Cos}[\text{ll Degree}]\,\text{Cos}[\delta\,\text{Degree}] + \text{Sin}[\text{ll Degree}]\,\text{Sin}[\delta\,\text{Degree}]);$$

$$\text{rn} = \left(1 - \frac{\text{smallrdn}}{\text{smallrn}} * \text{hdbyh}\right)\text{rBn} + \left(\frac{\text{smallrdn}}{\text{smallrn}} * \text{hdbyh}\right)\left(\frac{1+\text{Cos[s Degree]}}{2}\right) + \rho g\left(\frac{1-\text{Cos[s Degree]}}{2}\right);$$

$$\text{xcMin} = \frac{1}{\text{smallrn rn hBar}}\left(\frac{\text{frPrimeUc (tPrimeMin} - \text{tambPrime)}}{\text{frPrime}\tau\alpha\text{Bar}}\right);$$

$$\phi\text{Max} = \text{Exp}\left[\left(\text{capitalA} + \text{capitalB}\left(\frac{\text{rn}}{\text{r}}\right)\right)\left(\text{xcMin} + \text{capitalC xcMin}^2\right)\right];$$

$$\text{htBar} = \text{r hBar};$$

$$\text{qMax} = \text{ac frPrime}\tau\alpha\text{Bar htBar n}\,\phi\text{Max};$$

$$\text{f2} = \frac{1}{\text{d}}\left(\text{qu} - \text{uas}\left(\left(\text{tPrimeMin} + \text{g}\left(\text{Exp[k f1]} - 1\right)\text{Exp[h d / cL]}\right) - \text{tenv}\right)\text{deltat}\right),$$

$$\text{Abs[f1} - \text{f2]} > 0.001,\ \text{tPrimeMin} = \text{tPrimeMin} + .001;$$

$$\text{f1} = \frac{(\epsilon\text{L (mDotCpMin))}\ (\text{tPrimeMin} - \text{tMin})}{\text{d}};$$

$$\text{x} = \text{ac frPrimeUc}\left(\frac{\text{deltat}}{\text{d}}\right);$$

$$\text{qu} = \text{qMax} - \text{a}\left(\text{Exp[b f1]} - 1\right)\left(1 - \text{Exp[c x]}\right)\left(\text{Exp[dd z]}\right) * \text{d};$$

$$\text{hs} = \text{ArcCos}[-\text{Tan[ll Degree]}\,\text{Tan}[\delta\,\text{Degree}]];$$

$$\text{smallrdn} = \frac{\text{Pi}}{24}\left(\frac{1-\text{Cos[hs Degree]}}{\text{Sin[hs Degree]} - \left(\frac{\text{Pi}}{180}\right)\text{hs Degree Cos[hs Degree]}}\right);$$

$$\text{smallrn} = \text{smallrdn}\left(1.07 + .025\,\text{Sin[hs Degree} - 60\,\text{Degree}]\right);$$

$$\text{rB} = (\text{Cos}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Cos}[\delta\,\text{Degree}] * \text{Cos}[\text{hs Degree}] + \text{Sin}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Sin}[\delta\,\text{Degree}]) / (\text{Cos}[\text{ll Degree}]\,\text{Cos}[\delta\,\text{Degree}] * \text{Cos}[\text{hs Degree}] + \text{Sin}[\text{ll Degree}]\,\text{Sin}[\delta\,\text{Degree}]);$$

$$\text{r} = \left(1 - \text{hdbyh}\right)\text{rB} + \text{hdbyh}\left(\frac{1+\text{Cos[s Degree]}}{2}\right) + \rho g\left(\frac{1-\text{Cos[s Degree]}}{2}\right);$$

$$\text{rBn} = (\text{Cos}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Cos}[\delta\,\text{Degree}] + \text{Sin}[(\text{ll} - \text{s})\,\text{Degree}] * \text{Sin}[\delta\,\text{Degree}]) / (\text{Cos}[\text{ll Degree}]\,\text{Cos}[\delta\,\text{Degree}] + \text{Sin}[\text{ll Degree}]\,\text{Sin}[\delta\,\text{Degree}]);$$

$$\text{rn} = \left(1 - \frac{\text{smallrdn}}{\text{smallrn}} * \text{hdbyh}\right)\text{rBn} + \left(\frac{\text{smallrdn}}{\text{smallrn}} * \text{hdbyh}\right)\left(\frac{1+\text{Cos[s Degree]}}{2}\right) + \rho g\left(\frac{1-\text{Cos[s Degree]}}{2}\right);$$

$$\text{xcMin} = \frac{1}{\text{smallrn rn hBar}}\left(\frac{\text{frPrimeUc (tPrimeMin} - \text{tambPrime)}}{\text{frPrime}\tau\alpha\text{Bar}}\right);$$

$$\phi Max = Exp\left[\left(capitalA + capitalB\left(\frac{rn}{r}\right)\right)\left(xcMin + capitalC\, xcMin^2\right)\right];$$

$$htBar = r\, hBar;$$

$$qMax = ac\, frPrime\tau\alpha Bar\, htBar\, n\, \phi Max;$$

$$f2 = \frac{1}{d}\left(qu - uas\left(\left(tPrimeMin + g\left(Exp[k\, f1] - 1\right) Exp[h\, d / cL]\right) - tenv\right) deltat\right),$$

$$c_{ac} = f2;\Big]$$

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For[ac = 10, ac ≤ 100, For[tMin = 70; tPrimeMin = tMin;
  ϵL = .7;
  mDotCpMin = 3400 * 31 * 12 * 3600;
  cL = ϵL mDotCpMin;
  d = 15 000 * 31 * 12 * 3600;
  ms = 100;
  cp = 4190;
  h = -4.002;
  k = 4.702;
  tenv = 21;
  uas = 6;
  deltat = 31 * 12 * 3600;
  b = 3.85;
  c = -0.15;
  dd = -1.959;
  frPrimeUc = 3.5;
  hBar = 19.16 * 1 000 000;
  frPrimeταBar = 0.72 * 0.94;
  n = 31;
  kT = 0.480;
  capitalA = 7.10 - 20.00 kT + 12.08 kT^2;
  capitalB = -8.02 + 18.16 kT - 10.68 kT^2;
  capitalC = -1.02 + 4.10 kT - 1.96 kT^2;
  hdbyh = 1.317 - 3.023 kT + 3.372 kT^2 - 1.769 kT^3;
  frPrimeτan = 0.72;
  ρg = 0.2;
  s = 39.8;
  ll = 39.8;
  tambPrime = 16.8;
  z = d / cL;
  δ = 23.45 Sin[360/365 (284 + 135) Degree];
  a = 0.015 ((ms * (cp/1000))/350)^-0.76;
  g = 0.2136 ((ms * cp/1000)/350)^-0.704;
```

$$f1 = \frac{(\epsilon L\ (mDotCpMin))\ (tPrimeMin - tMin)}{d};$$

$$x = ac\ frPrimeUc\left(\frac{deltat}{d}\right);$$

$$qu = qMax - a\left(Exp[b\ f1]\ - 1\right)\left(1 - Exp[c\ x]\right)\ (Exp[dd\ z])\ *\ d;$$

$$hs = ArcCos[-Tan[ll\ Degree]\ Tan[\delta\ Degree]];$$

$$smallrdn = \frac{Pi}{24}\left(\frac{1 - Cos[hs\ Degree]}{Sin[hs\ Degree] - \left(\frac{Pi}{180}\right)\ hs\ Degree\ Cos[hs\ Degree]}\right);$$

$$smallrn = smallrdn\left(1.07 + .025\ Sin[hs\ Degree - 60\ Degree]\right);$$

$$rB = (Cos[(ll - s)\ Degree] * Cos[\delta\ Degree] * Cos[hs\ Degree] + Sin[(ll - s)\ Degree] * Sin[\delta\ Degree])\ /\ (Cos[ll\ Degree]\ Cos[\delta\ Degree] * Cos[hs\ Degree] + Sin[ll\ Degree]\ Sin[\delta\ Degree]);$$

$$r = \left(1 - hdbyh\right)\ rB + hdbyh\left(\frac{1 + Cos[s\ Degree]}{2}\right) + \rho g\left(\frac{1 - Cos[s\ Degree]}{2}\right);$$

$$rBn = (Cos[(ll - s)\ Degree] * Cos[\delta\ Degree] + Sin[(ll - s)\ Degree] * Sin[\delta\ Degree])\ /\ (Cos[ll\ Degree]\ Cos[\delta\ Degree] + Sin[ll\ Degree]\ Sin[\delta\ Degree]);$$

$$rn = \left(1 - \frac{smallrdn}{smallrn} * hdbyh\right)\ rBn + \left(\frac{smallrdn}{smallrn} * hdbyh\right)\left(\frac{1 + Cos[s\ Degree]}{2}\right) + \rho g\left(\frac{1 - Cos[s\ Degree]}{2}\right);$$

$$xcMin = \frac{1}{smallrn\ rn\ hBar}\left(\frac{frPrimeUc\ (tPrimeMin - tambPrime)}{frPrime\tau\alpha Bar}\right);$$

$$\phi Max = Exp\left[\left(capitalA + capitalB\left(\frac{rn}{r}\right)\right)\left(xcMin\ +\ capitalC\ xcMin^2\right)\right];$$

$$htBar = r\ hBar;$$

$$qMax = ac\ frPrime\tau\alpha Bar\ htBar\ n\ \phi Max;$$

$$f2 = \frac{1}{d}\left(qu\ - uas\left(\left(tPrimeMin + g\left(Exp[k\ f1] - 1\right)\ Exp[h\ d\ /\ cL]\right) - tenv\right)\ deltat\right),$$

$$Abs[f1 - f2] > 0.001,\ tPrimeMin = tPrimeMin + .001;$$

$$f1 = \frac{(\epsilon L\ (mDotCpMin))\ (tPrimeMin - tMin)}{d};$$

$$x = ac\ frPrimeUc\left(\frac{deltat}{d}\right);$$

$$qu = qMax - a\left(Exp[b\ f1]\ - 1\right)\left(1 - Exp[c\ x]\right)\ (Exp[dd\ z])\ *\ d;$$

$$hs = ArcCos[-Tan[ll\ Degree]\ Tan[\delta\ Degree]];$$

$$smallrdn = \frac{Pi}{24}\left(\frac{1 - Cos[hs\ Degree]}{Sin[hs\ Degree] - \left(\frac{Pi}{180}\right)\ hs\ Degree\ Cos[hs\ Degree]}\right);$$

$$smallrn = smallrdn\left(1.07 + .025\ Sin[hs\ Degree - 60\ Degree]\right);$$

$$rB = (Cos[(ll - s)\ Degree] * Cos[\delta\ Degree] * Cos[hs\ Degree] + Sin[(ll - s)\ Degree] * Sin[\delta\ Degree])\ /\ (Cos[ll\ Degree]\ Cos[\delta\ Degree] * Cos[hs\ Degree] + Sin[ll\ Degree]\ Sin[\delta\ Degree]);$$

$$r = \left(1 - hdbyh\right)\ rB + hdbyh\left(\frac{1 + Cos[s\ Degree]}{2}\right) + \rho g\left(\frac{1 - Cos[s\ Degree]}{2}\right);$$

$$rBn = (Cos[(ll - s)\ Degree] * Cos[\delta\ Degree] + Sin[(ll - s)\ Degree] * Sin[\delta\ Degree])\ /\ (Cos[ll\ Degree]\ Cos[\delta\ Degree] + Sin[ll\ Degree]\ Sin[\delta\ Degree]);$$

```
rn = (1 - smallrdn/smallrn * hdbyh) rBn + (smallrdn/smallrn * hdbyh) ((1 + Cos[s Degree])/2) +
   ρg ((1 - Cos[s Degree])/2);
xcMin = 1/(smallrn rn hBar) ((frPrimeUc (tPrimeMin - tambPrime))/frPrimeταBar);
ϕMax = Exp[(capitalA + capitalB (rn/r)) (xcMin + capitalC xcMin^2)];
htBar = r hBar;
qMax = ac frPrimeταBar htBar n ϕMax;
f2 = 1/d (qu - uas ((tPrimeMin + g (Exp[k f1] - 1) Exp[h d / cL]) - tenv) deltat),
cac = f2;];
ac = ac + 10, {}]; ListLinePlot[{{10, c10}, {20, c20}, {30, c30}, {40, c40},
 {50, c50}, {60, c60}, {70, c70}, {80, c80}, {90, c90}, {100, c100}}]
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