```
clear all
close all

%Import Data
%NOTE: Each data point is the mean W/m^2 for the following 60 seconds
%Conjoin months
data = importdata("2019_1.txt");
data = data.data;
for i = 2:9
    disp("Importing 2019_" + num2str(i) + ".txt");
    import = importdata("2019_" + num2str(i) + ".txt");
    import = import.data;
    data = cat(1,data,import);
end
%Remove NaNs
data(isnan(data)) = 0;




%Angle of visibility above the horizon
A = 18;

%Days to project
D = 120;

%Panel cost per panel
PanelC = 280;

%Add Extra Material Costs / Panel (Supports, electrical etc)
MCost = 20;
C = PanelC + MCost;

%Area per panel m^2
Area = 1.64*0.992;

%Panel Wattage per  panel, per 1000W/m^2 irradiance
W = 290;

%Starting number of panels
P0 = 22;

%Initial Investment
Inv = 1;

%Convert Inv to Panel number
%P0 = floor(Inv/C);

%Average over N days of irradiance data
Average = 1;

DSI = data(:,12);
```

```
DSI = AV(DSI, Average)';
HSI = data(:,27);
HSI = AV(HSI, Average)';

%Zen Angle
Zen = data(:,35);
Hour = data(:,6);
Minute = data(:,7);

DATETIME = data(:,3:8);
DATETIME(:,8) = 0;
LAT = -34.92866;
LON = 138.59863;
TZ = 9.5;
[Z,Az] = solarPosition(DATETIME,LAT,LON,TZ,0,0);

UUU = Z-90+Zen;

%No power if can't see the sun
HSI = (Zen < 90 - A).*HSI;
DSI = (Zen < 90 - A).*DSI;
HSI = (Zen ~= 0).*HSI;
DSI = (Zen ~= 0).*DSI;



%points per day
Sf = 60*24;

%Only display n days of points
n = D*Sf;

figure
hold on
plot(HSI(1:n));
plot(DSI(1:n));
title({"Solar energy incident at " + A + " Degrees above the
 Horizon", "W/m^2" })
hold off

%Convert useful power to revenue
%c/kWh
ckWh = 15;
%dol/kWh
dkWh = ckWh/100;
%dol/kWh == dol/kJ(h/s) -> dol/kJ
dkJ = dkWh/3600;
%dol/J
dJ = dkJ / 1000;


%Convert Sun to O/P Power

%Calculate W/m^2
```

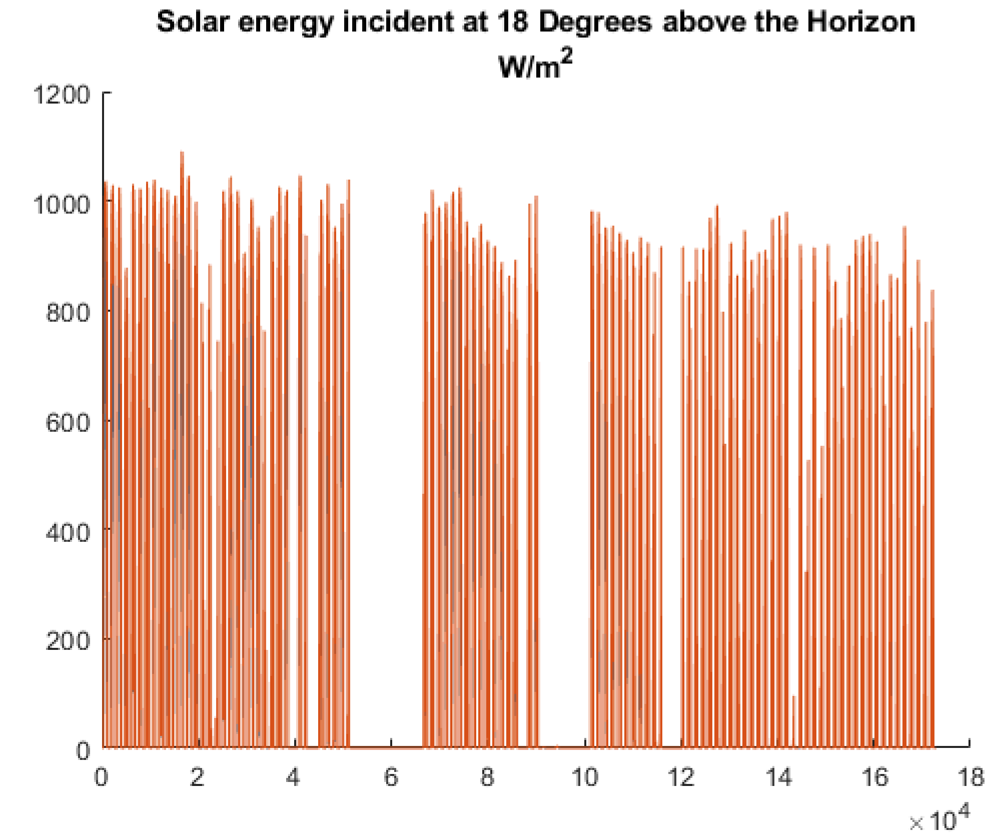
```
Wpm = W/A;

%Useful watts per incident watt (STC of 1000W/m^2)
%Provided Wattage is for 1000W in, this scales to
%give Wattage for 1W in, making further scaling possible
UWR = Wpm/1000;

%Convert mean sun W to sun J - times by 60seconds
%Solar data is provided minute by minute
%We now have Joules per minute
DSIJm = DSI*60;
HSIJm = HSI*60;

%Convert Incident J/mm^2 to useful J/mm^2
DUJ = DSIJm * UWR;
HUJ = HSIJm * UWR;

%Scale by panel area and number
DUJE = P0*A*DUJ;
HUJE = P0*A*HUJ;

%Convert Useful Joules/min to dollars per minute
DDol = DUJE * dJ;
HDol = HUJE * dJ;

%Add all dollar amounts at each minute
Drevenue = cumsum(DDol);
Hrevenue = cumsum(HDol);



%CALCULATE REBATE
%Take final $ value
TotPro = Drevenue(n);
%Find Joule amount
Joules = TotPro / dJ;
%Joules per day
JpD = Joules / D;
%Find total Joules until 2030
TotJou = JpD * 365 * 9;
%Convert Joules to Watt Hours
TotWH = TotJou / 3600;
%Convert to MWh
TotMWH = TotWH / (10 ^ 6);
%Calculate rebate ($22 per MWh produced)
Rebate = 22 * TotMWH;


%Plot revenue
figure
t = 1:n;
hold on;
plot(t,Drevenue(1:n));
plot(t,Hrevenue(1:n));
```

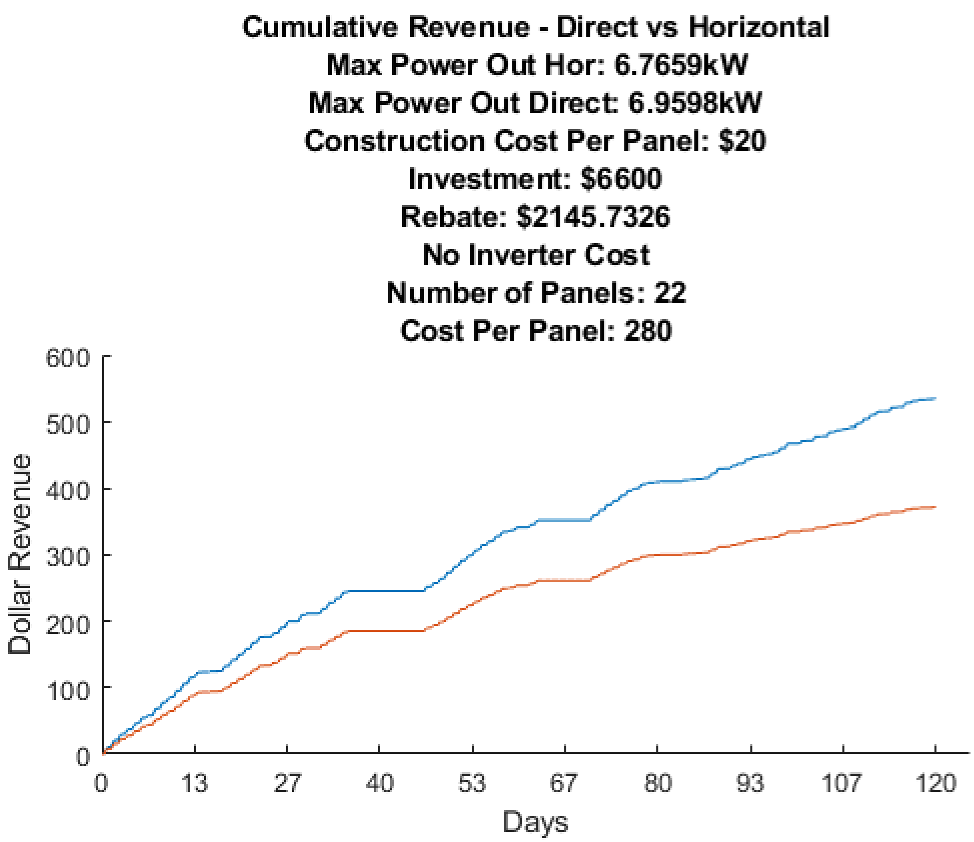
```
hold off
ylabel("Dollar Revenue");
title({"Cumulative Revenue - Direct vs Horizontal","Max Power Out Hor:
 " + P0*max(HSI)*A*UWR/1000 + "kW",...
    "Max Power Out Direct: " + P0*max(DSI)*A*UWR/1000 + "kW",...
    "Construction Cost Per Panel: $" + MCost,"Investment: $" +
 C*P0 ,"Rebate: $"+Rebate, "No Inverter Cost",...
    "Number of Panels: "+P0,...
    "Cost Per Panel: " + PanelC});



ticks = linspace(1,n,10);
xticks(ticks)
xticklabels( round(ticks/ Sf, 0))
xlabel("Days")


%Reinvest to increase panels once possible
Pn = P0;
profit = Drevenue;
SUM = Drevenue;
for i = 1 : n
   if (profit(i) > C)
      Pn = Pn + 1;
      profit(i:end) = profit(i:end) - C;
   end
   SUM(i) = SUM(i).*(Pn/P0);
end




%Plot revenue
figure
t = 1:length(profit(1:n));
plot(t,profit(1:n));
ylabel("Dollar Profit");
ticks = linspace(1,n,10);
xticks(ticks)
xticklabels( round(ticks/ Sf, 0))
xlabel("Days")

%Plot reinvested turnover
figure
t = 1:length(SUM(1:n));
plot(t,SUM(1:n));
ylabel("Dollar Profit");
ticks = linspace(1,n,10);
xticks(ticks)
xticklabels( round(ticks/ Sf, 0))
xlabel("Days")
title({"Turnover with Reinvestment", P0 + " Panels, $" + (C*P0 -
 Rebate), "m^2 required: " + ( ( 2 * ceil(sqrt(P0)) - 1))^2});
```

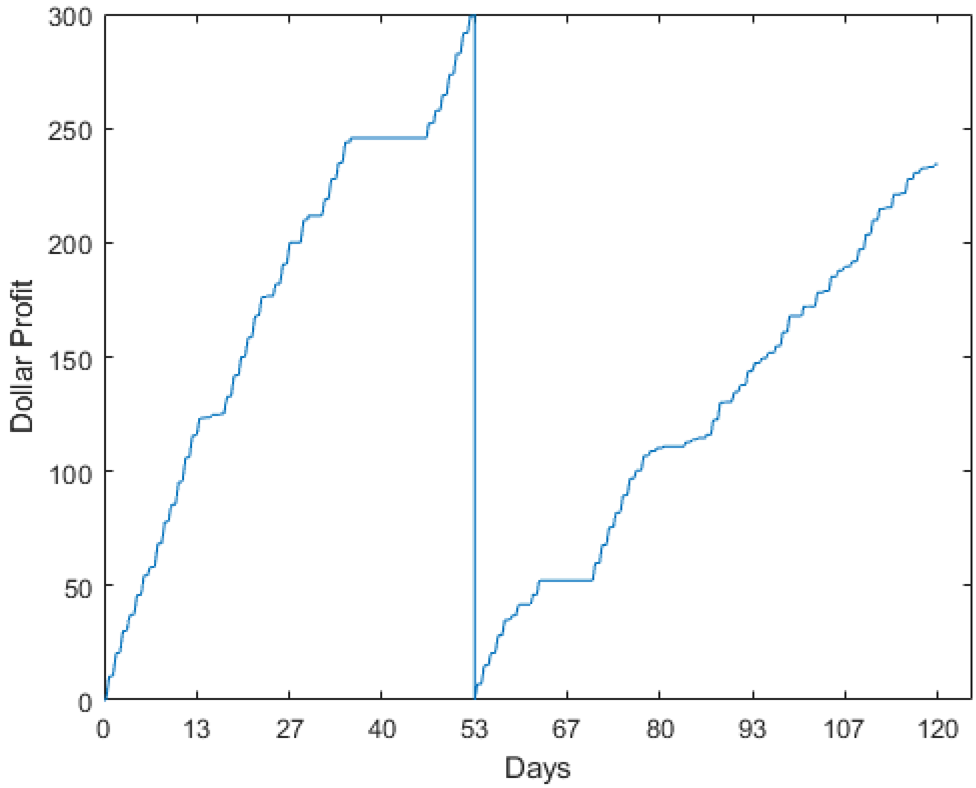
```
%}

Importing 2019_2.txt
Importing 2019_3.txt
Importing 2019_4.txt
Importing 2019_5.txt
Importing 2019_6.txt
Importing 2019_7.txt
Importing 2019_8.txt
Importing 2019_9.txt
```

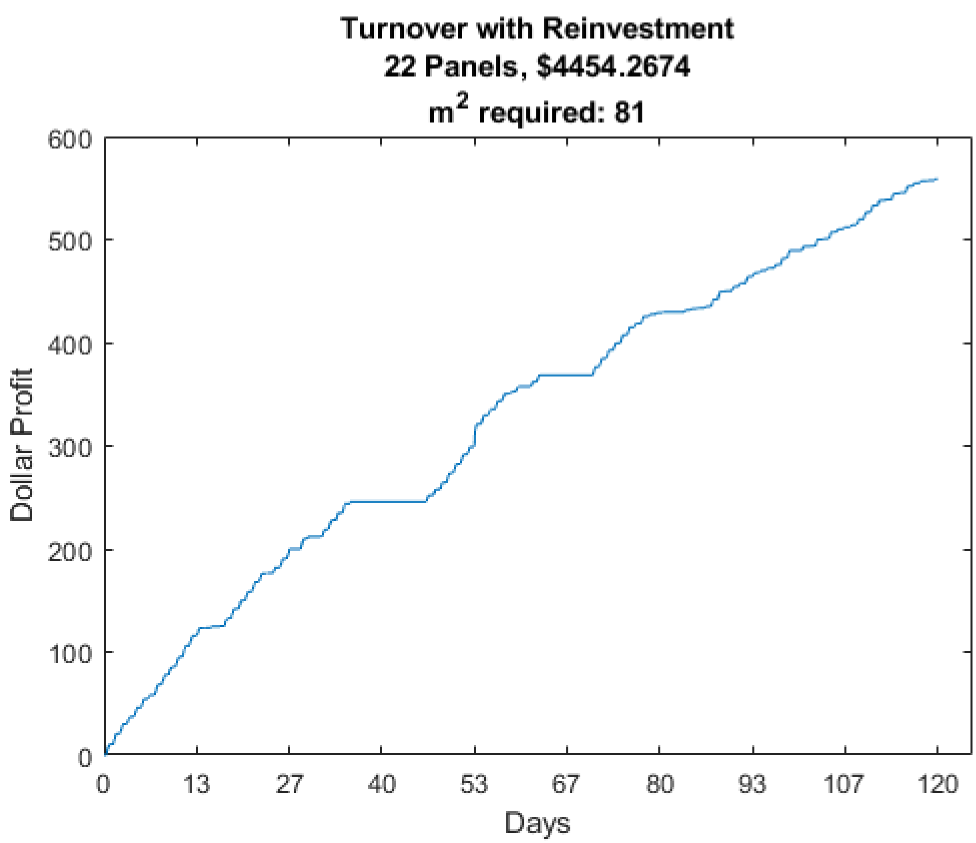
Dependencies

```
%X = 1D vector to average
%n = number of points per average
%Averages vector X every n points
function result = AV(X, n)

    %Fit so divisible
    est = length(X)/n;
    exact = floor(est);
    X = X(1:n*exact);

    X = reshape(X, n, []);
    result = sum(X, 1)./size(X,1);

end
```


Solar energy incident at 18 Degrees above the Horizon
W/m2
1200
1000
800
600
400
200
0
0
2
4
6
8
10
12
14
16
18
×10^4


Cumulative Revenue - Direct vs Horizontal
Max Power Out Hor: 6.7659kW
Max Power Out Direct: 6.9598kW
Construction Cost Per Panel: $20
Investment: $6600
Rebate: $2145.7326
No Inverter Cost
Number of Panels: 22
Cost Per Panel: 280
Dollar Revenue
600
500
400
300
200
100
0
0
13
27
40
53
67
80
93
107
120
Days


Dollar Profit
Days
0
50
100
150
200
250
300
0
13
27
40
53
67
80
93
107
120


Turnover with Reinvestment
22 Panels, $4454.2674
m2 required: 81
Dollar Profit
Days
0
100
200
300
400
500
600
0
13
27
40
53
67
80
93
107
120

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