AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH (AIUB)

Faculty of Engineering

Bachelor of Science in Electrical and Electronic Engineering

Renewable Energy Technology lab performance test

Spring 2020-21 **Total Marks: 20** **Time: 1 hr 30 mins**

The government will install the biggest solar power plant of the country at the haor areas of Sunamganj to provide electricity to about 900 families. The plant will be set up at Sulla upazila of the north-eastern district. Bangladesh Power Development Board (BPDB) inked a deal last week with Rahimafrooz Renewable Energy Ltd to construct the plant and associated distribution line at a cost of Tk 30.5 crore. The plant is expected to generate 500 kW load per day, sufficient to meet a significant portion of the electricity demand of Aguai village of Habibpur union parishad in Sunamganj. The system will consist of **ABCD** panels of 280 watts. A six-kilometer distribution line will be built to provide electricity connection to the area. The plant's per unit production cost is expected to be Tk 45, but customers will pay Tk 8-10 depending on the amount they will consume as the government will provide subsidies on it. Rahimafrooz will maintain the first-year operation of the plant, with BPDB to take over from then. The plant is expected to last about 25-30 years.

Now design the above-mentioned solar power plant using RETscreen software. Paste the screenshot of your solution in the appropriate spaces provided below (there are in total 6 screenshots). If any parameters are not given, then assume a suitable value based on lab experiment number 5 and mention the values in your answer.

*This is an individual task

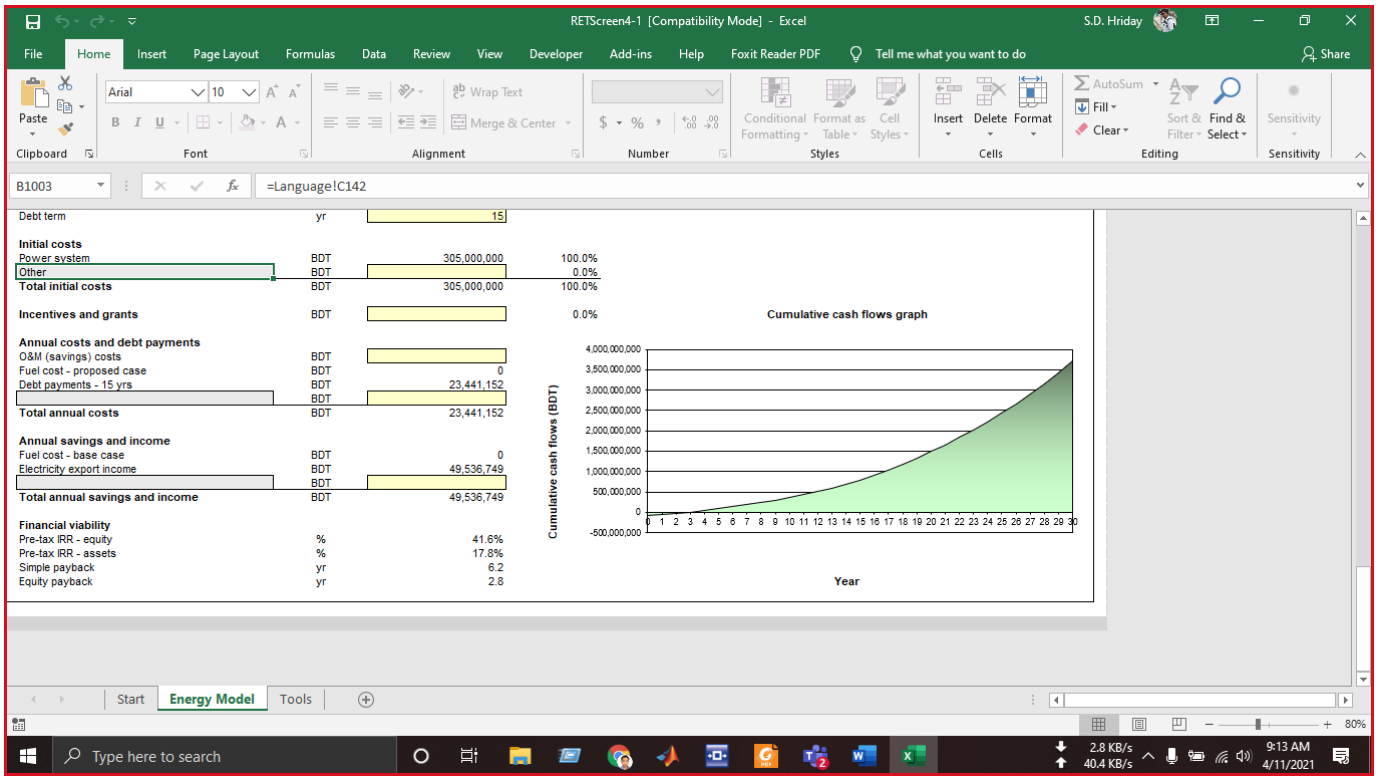
*Here **A = 3rd digit of your ID, B = 4th digit of your ID, C = 5th digit of your ID and D = 6th digit of your ID**. For example, If ID = **18-7825 3-2**, then number of panels will be **7825.**

*Convert the word file into PDF and rename the file with your **ID only.**

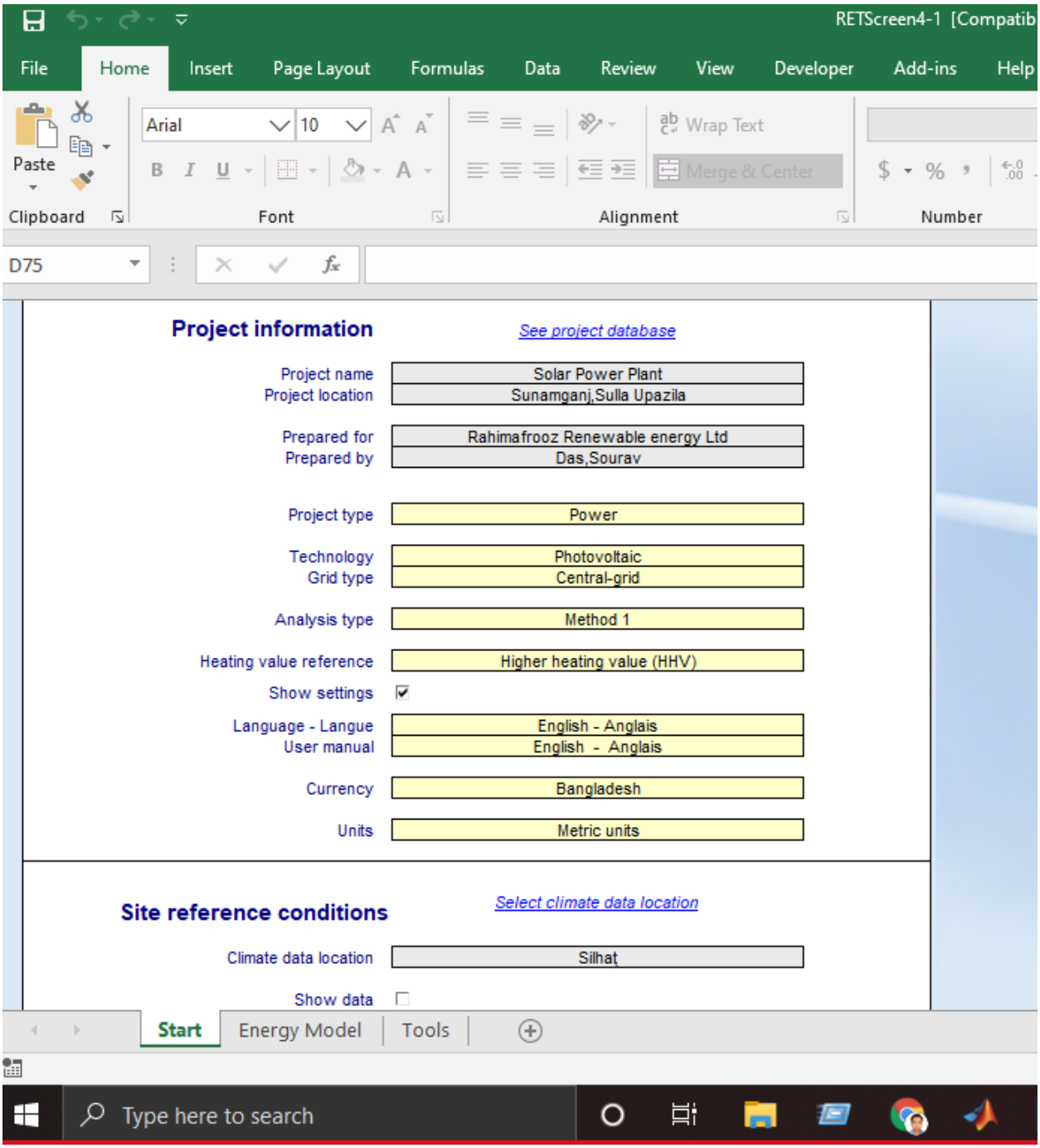
*Upload the file in team's assignment section

* **50%** of total marks will deducted in case of delayed submission

Progress after 50 mins (paste screenshot of your progress after 50 mins is gone):



1. **Project information: (use your name and ID while giving the information)**



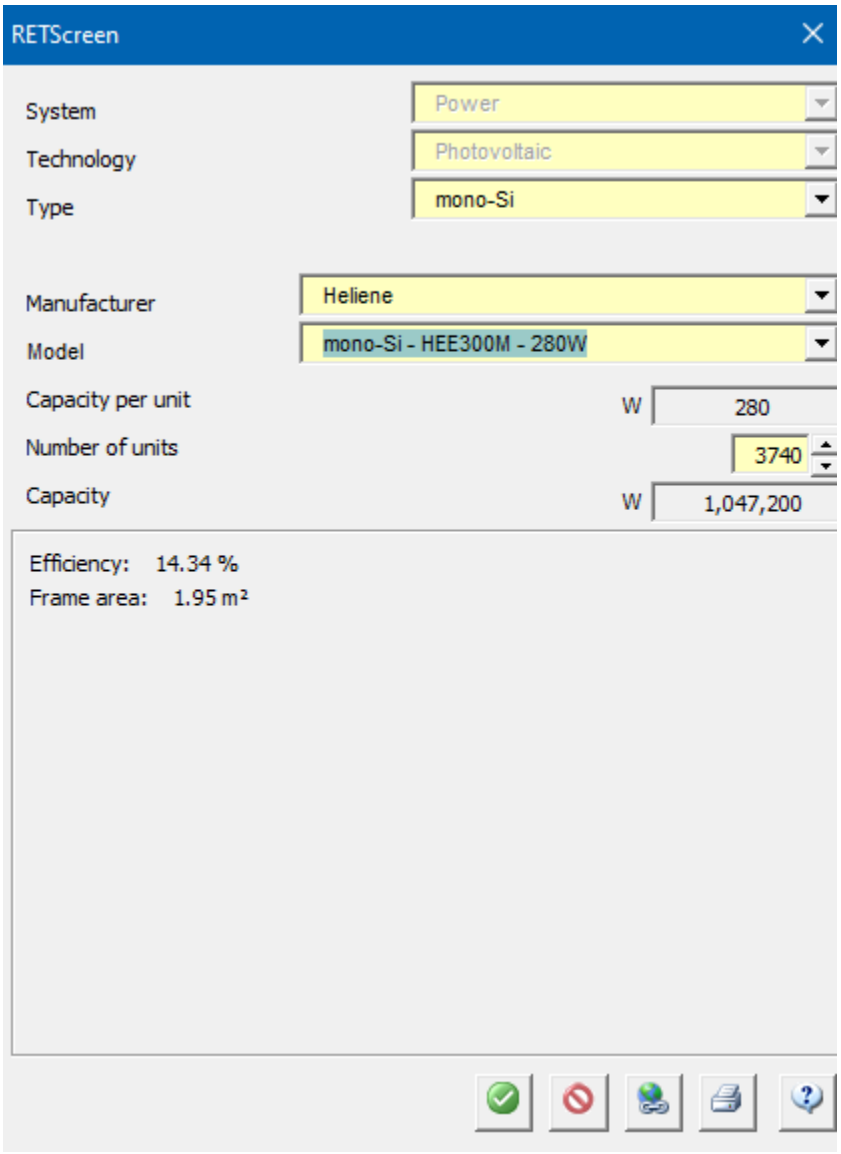
2. Climate data:

RETScreen

Country - region	Bangladesh		
Province / State	n/a		
Climate data location	Sihat		
Latitude	°N	24.9	
Longitude	°E	91.9	Source
Elevation	m	14	NASA
Heating design temperature	°C	13.0	NASA
Cooling design temperature	°C	30.9	NASA
Earth temperature amplitude	°C	13.5	NASA

	Air temperature	Relative humidity	Daily solar radiation - horizontal	Atmospheric pressure	Wind speed	Earth temperature	Heating degree-days	Cooling degree-days
	°C	%	kWh/m²/d	kPa	m/s	°C	°C-d	°C-d
Jan	17.9	56.2%	4.37	98.9	2.0	18.8	3	245
Feb	20.9	50.6%	5.04	98.7	2.1	22.5	0	305
Mar	24.5	52.7%	5.60	98.4	2.3	26.5	0	449
Apr	25.6	69.1%	5.62	98.2	2.2	27.1	0	468
May	26.4	77.3%	4.84	98.0	2.1	27.9	0	509
Jun	27.0	83.8%	4.22	97.7	2.1	27.8	0	509
Jul	26.8	85.8%	4.18	97.7	1.9	27.3	0	520
Aug	26.8	84.8%	4.30	97.8	1.8	27.3	0	522
Sep	26.1	84.1%	3.94	98.1	1.7	26.5	0	483
Oct	24.5	78.3%	4.36	98.5	1.6	24.6	0	449
Nov	21.4	70.9%	4.29	98.8	1.8	21.3	0	343
Dec	18.6	62.9%	4.17	99.0	1.9	18.7	0	266
Annual	23.9	71.5%	4.57	98.3	2.0	24.7	3	5,067
Source	NASA	NASA	NASA	NASA	NASA	NASA	NASA	NASA
			Measured at	m	10	0		

3. Proposed power system:

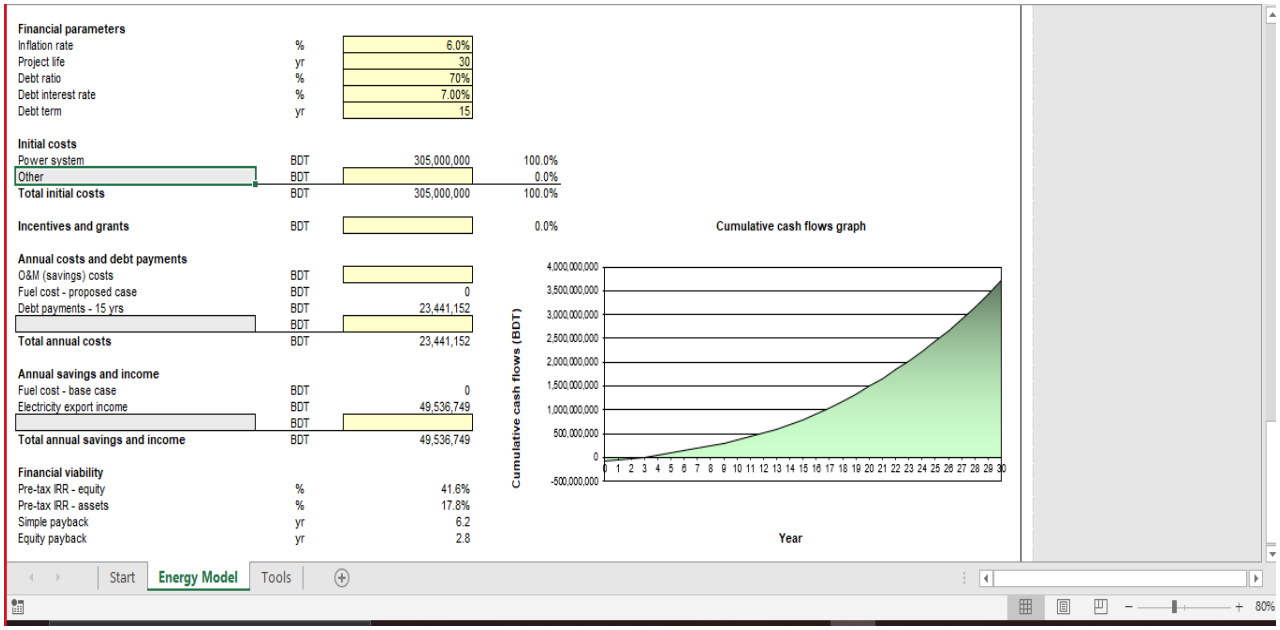


4. Emission analysis:

Emission Analysis

Base case electricity system (Baseline)		GHG emission factor (excl. T&D)	T&D losses	GHG emission factor	
Country - region	Fuel type	tCO2/MWh	%	tCO2/MWh	
Bangladesh	All types	0.584		0.584	
Electricity exported to grid	MWh	1,101	T&D losses		
GHG emission					
Base case	tCO2	643.3			
Proposed case	tCO2	0.0			
Gross annual GHG emission reduction	tCO2	643.3			
GHG credits transaction fee	%				
Net annual GHG emission reduction	tCO2	643.3	is equivalent to	118	Cars & light trucks not used
GHG reduction income					
GHG reduction credit rate	BDT/tCO2				

5. Financial analysis:



Financial parameters			
Inflation rate	%	6.0%	
Project life	yr	30	
Debt ratio	%	70%	
Debt interest rate	%	7.00%	
Debt term	yr	15	
Initial costs			
Power system	BDT	305,000,000	100.0%
Other	BDT		0.0%
Total initial costs	BDT	305,000,000	100.0%
Incentives and grants	BDT		0.0%
Annual costs and debt payments			
O&M (savings) costs	BDT		
Fuel cost - proposed case	BDT	0	
Debt payments - 15 yrs	BDT	23,441,152	
	BDT		
Total annual costs	BDT	23,441,152	
Annual savings and income			
Fuel cost - base case	BDT	0	
Electricity export income	BDT	49,536,749	
	BDT		
Total annual savings and income	BDT	49,536,749	
Financial viability			
Pre-tax IRR - equity	%	41.6%	
Pre-tax IRR - assets	%	17.8%	
Simple payback	yr	6.2	
Equity payback	yr	2.8	

6. Cumulative cash flow graph: