Feasibility Study of Solar Canopies in a University Parking Lot

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- Determine economic & engineering feasibility of solar canopies in a university parking lot
- Produce a written feasibility study & a poster detailing the recreational benefits and potential environmental impacts

ILLINOIS

Background and Motivation

- University of Illinois 2050 deadline
- Lack of EV charging stations around campus
- Blue water requires massive amounts of energy, opportunity to be offset with solar canopy at E14

Scope & Schedule

Scope

-Task 1

- Complete with the exception of 1.4
  - Waiting on data from University Parking

-Task 2

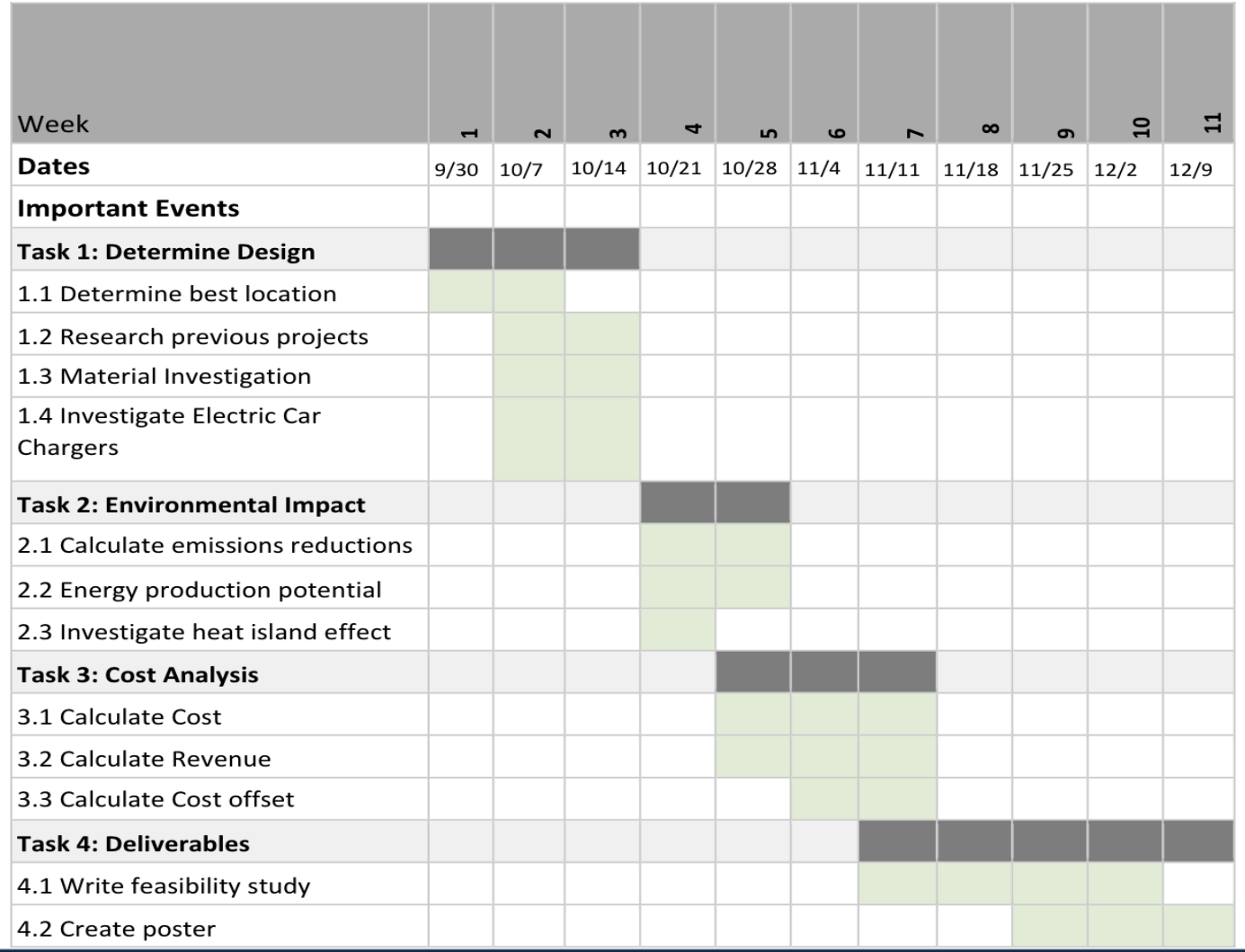
- Complete

-Task 3

- Waiting on completion of task 1

-Task 4

- Starting upon completion of task 2 & 3
- Documenting the methodology and description of tasks as we go



Week	1	2	3	4	5	6	7	8	9	10	11
Dates	9/30	10/7	10/14	10/21	10/28	11/4	11/11	11/18	11/25	12/2	12/9
Important Events											
Task 1: Determine Design											
1.1 Determine best location											
1.2 Research previous projects											
1.3 Material Investigation											
1.4 Investigate Electric Car Chargers											
Task 2: Environmental Impact											
2.1 Calculate emissions reductions											
2.2 Energy production potential											
2.3 Investigate heat island effect											
Task 3: Cost Analysis											
3.1 Calculate Cost											
3.2 Calculate Revenue											
3.3 Calculate Cost offset											
Task 4: Deliverables											
4.1 Write feasibility study											
4.2 Create poster											

Preliminary Results / Analysis

- Material investigation
- Static electric car charging stations
- Heat island effect
- Parking lot location

Charging Level	Vehicle Range Added per Charging Time and Power	Supply Power
AC Level 1	4 mi/hour @ 1.4kW 6 mi/hour @ 1.9kW	120VAC/20A *(12-16A continuous)*
AC Level 2	10 mi/hour @ 3.4kW 20 mi/hour @ 6.6kW 60 mi/hour @ 19.2 kW	208/240VAC/20-100A *(16-80A continuous)*
DC Fast Charging	24 mi/20minutes @24kW 50 mi/20minutes @50kW 90 mi/20minutes @90kW	208/480VAC 3-phase *(input current proportional to output power;* *~20-400A AC)*

Preliminary Results / Analysis

Location and Station Identification

Requested Location	1600 South Oak Street, Champaign, Illinois
Weather Data Source	Lat, Lon: 40.09, -88.26 1.1 mi
Latitude	40.09° N
Longitude	88.26° W

PV System Specifications *(Residential)*

DC System Size	10558.4 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	40.09°
Array Azimuth	180°
System Losses	14.08%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1

Economics

Average Retail Electricity Rate	0.091 $/kWh

Performance Metrics

Capacity Factor	16.0%

RESULTS

Print Results

14,757,769 kWh/Year*

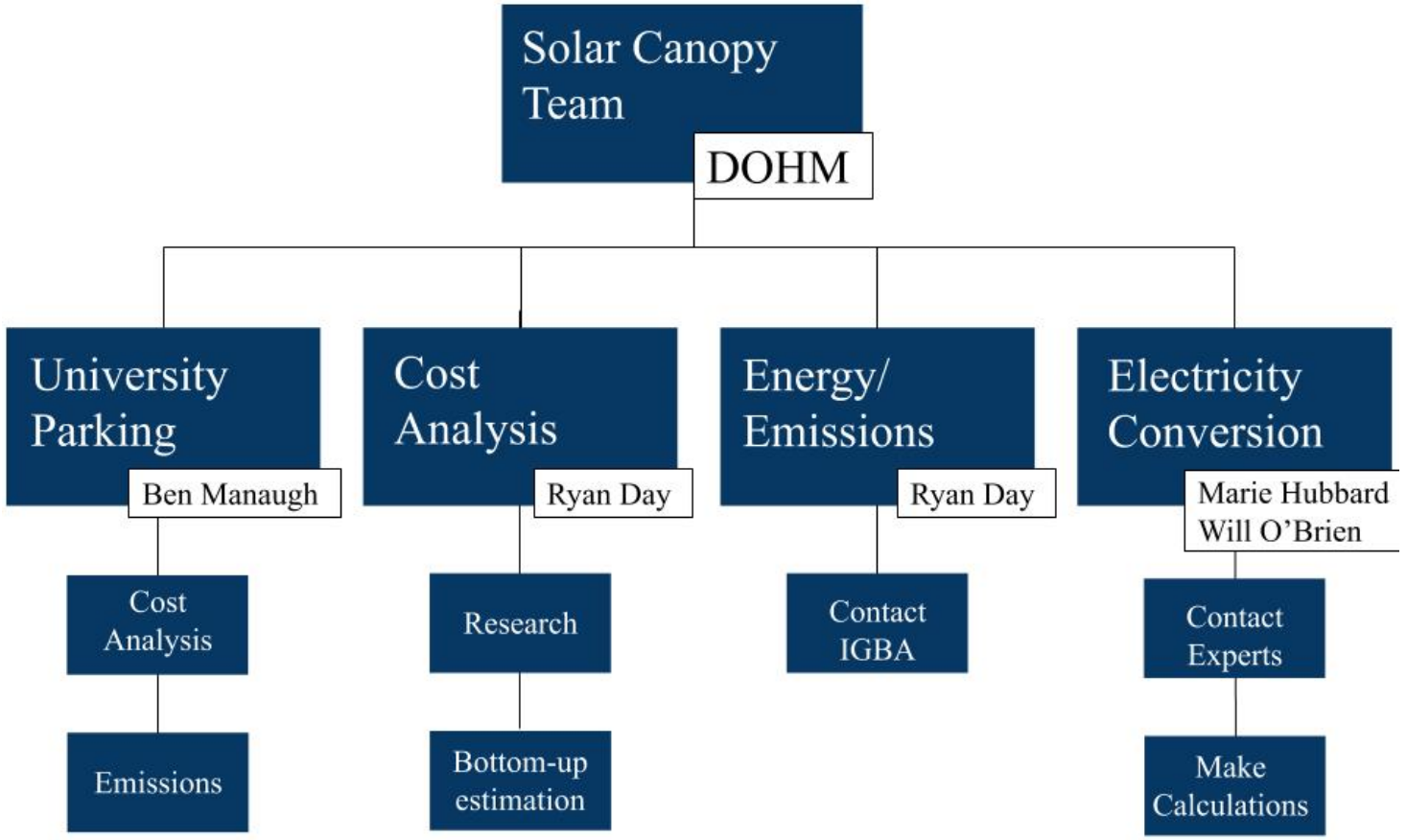
System output may range from 13,900,343 to 15,306,758 kWh per year near this location.
Click HERE for more information.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Value ($)
January	3.67	1,029,345	93,259
February	4.27	1,052,281	95,337
March	4.85	1,292,768	117,125
April	5.48	1,366,532	123,808
May	5.41	1,350,524	122,357
June	5.86	1,390,125	125,945
July	5.97	1,440,540	130,513
August	6.00	1,437,846	130,269
September	5.87	1,356,848	122,930
October	4.80	1,222,340	110,744
November	3.81	989,772	89,673
December	2.96	828,850	75,094
Annual	4.91	14,757,771	$ 1,337,054

2018 AASHE report: UIUC emitted **383,297 metric tons** of carbon dioxide

Environmental Protection Agency: solar canopy production equivalent to reducing emissions by **10,436 metric tons** (2.7% of campus emissions;1,250 homes for a year)

Organizational Breakdown Structure



Future Work

- Continue with the cost analysis
- Continue with emissions reductions calculations
- Parking lot data challenges
- Synthesize our results
- Write the report
- Create the poster