University of Illinois is a signatory to American Colleges and Universities Presidents Climate Commitment to reduce emission and reach carbon neutrality by 2050. Also, U of I is a signatory to the Resilience Commitment to help communities to adapt to the negative impacts of climate change. UIUC strategy to reach carbon neutrality is through energy conservation and renewable energy. Currently, UIUC campus has approximately 2million sq.ft. of space that is LEED certified. UIUC current construction standards exceed the minimum state energy performance requirements. F&S team at UIUC undertook numerous retro commissioning projects to maximize energy savings. UIUC completed several Energy Performance Contracting to design and implement projects that saves energy. All these efforts have succeeded to reduce energy consumption by approximately 40% since 2008 baseline. The other strategy to meet UIUC commitment is to generate renewable energy. UIUC built Solar Farms 1 & 2 that generate approximately 25,000 MWh and purchased 25,000 MWh wind generated power from Prairieland Energy.

To meet the university’s carbon neutrality goals, there is an important milestone to achieve, which is adding another 90,000MWh to bring the total energy from renewable sources to 140,000MWhr by 2025. F&S team collaborated with UIC (UIC need 80,000MWh to meet their commitment) and the System Office to engage COHO, a reputable market energy consultant to develop this comprehensive study to identify and evaluate options to meet the university goals. The following are some terminologies that will be used throughout the COHO’s report and our presentation:

**REC** stands for Renewable Energy Certificates and sometimes it is called Renewable Energy Credits. Each REC represents the production of one megawatt-hour of renewable power added to the electric grid, so each Mega What hour equals one REC. This is an accounting methodology that provides the institution the legal right to claim the usage of Renewable Energy.

**PPA** stands for Power Purchase Agreement and it is a contract to buy electricity and receive RECs. In this type of agreements, an institution guarantees fixed price for electricity generated from new-built Renewable Energy project, then consume or sell some of this electricity back to the grid, and receive RECs as a result of this investment.

**NPV** stands for Net Present Value which is the todays value of the estimated cost over the 15-year period which is the term of the agreement, with a discount rate of 5%.

**BAU** stand for Business as Usual which represents power production using the current co-generation power plants, on-site two solar farms we currently have, the wind Power Purchase Agreement, and what we purchase from the grid on the floating market price.

**MISO** stands for Midcontinent Independent System Operator. MISO Manages the generation and transmission of high-voltage electricity across 15 states, mostly in the Midwest region, and the Canadian province of Manitoba for more than 42 million people including central Illinois region.

To conduct this study, It was essential first to study the University current energy profile. UIUC currently produce electricity from three main sources, **Abbot Power Plant** where we mainly use natural gas to produce electricity**, Solar Farms 1 & 2**, and a **Wind Farm** through Power Purchase Agreement. The balance between what we produce, which is approximately 282k MWh, and what we consume, which is approximately 392k MWh is purchased from the grid. About 60% of UIUC electrical demand is produced at Abbott Power Plant, 7% of UIUC electrical demand is from solar farm 1 & 2, and 6% from Wind. The remaining 28% is purchased from the grid. For the purpose of this study, this is called Business As Usual because all the considered options, to achieve the university sustainability goals, are compared to this baseline if you well.

To meet the next commitment milestone, which is adding 90,000 MWHr for UIUC and 80,000MWHr for UIC, from renewable sources, COHO identified and evaluated several options. Those options were evaluated based on **economics**, wither achieve savings or incur premiums, **environmental impact** to maximize avoided grid emissions, **Risks** associated with each option, and **ease of implementation** during contract execution and post contract execution management.

* The first option is unbundled RECs, where U of I pays a fixed dollar amount per MWh for each REC on the national market, to legally claim the use of renewable energy. In this case, UIUC and UIC are just acquiring the RECs but no electricity from renewable sources is purchased by U of I and no additional renewable electricity will be produced or added to the regional or national power grid. The estimated total cost to UIUC over 15 years is about $2.3M. The Net Present Value for this contract is $1.7M. This is the easiest option to implement both in procurement and negotiation, or the in the post contract management. In terms of risks, the price of RECs is highly volatile. For example, the current REC price is $3 while it was $7 last year. The university can mitigate this risk by locking in REC pricing for up to 5 years, but this comes with significant premium.
* The second option is to build an onsite solar farm. Similar to solar farm 1 and 2, UIUC and UIC pay fixed price per MWh for electricity generated from new-built solar project on UIUC campus or nearby land. The University receives RECs, 90k for UIUC, and 80k for UIC. Some of this electricity will be consumed on UIUC campus and the remaining will be sold to the grid at floating wholesale market rate. The estimated premium cost to UIUC is about $16.6M. The NPV for this amount is $9.9M. In addition, building such a massive 170,000MWh solar farm will need between 350 to 500 acres of land and the estimated leasing cost is $4.5M to 6.4M over a 15 years term. This option requires UIUC to acquire the land, a competitive RFP process, and 4-6 month of negotiation. The selected developer will be responsible for the development and the operation of the solar farm throughout the 15 years term. Because the University commits a fixed price per MWh to a developer for 15 years, potential price fluctuations constitutes a downside risk if the wholesale market price at the time the electricity is generated is less than the fixed price in the PPA.
* The third option is Indirect PPA. In this method, U of I guarantee fixed price for electricity generated from new-built Renewable Energy project. The generated electricity will not be delivered to the campus and will be sold directly to the local grid at floating wholesale market price. Similar to onsite solar farm, the Downside Risk exists The new solar farm can be located anywhere in US, each potential location has different cost implication, and therefore, this option has three sub-options:
* If the farm is located in Illinoi, this will cost UIUC $11.1M over the 15 year term with NPV of approximately $6.6M.
* If the farm is located in MISO region, this option would actually save UIUC about $5M over the 15 year term with NPV of approximate savings of $2.9M.
* If the farm is located elsewhere in US, for example, Texas, the savings will be even slightly bigger to about $6M with NPV of $3.4M over BAU.

This option also requires a competitive RFP with 4-6 month of negotiation. The developer is responsible for developing and operating the solar farm.

* The fourth option is Physical Indirect PPA. In this option, U of I guarantee fixed price for electricity generated from new-built Renewable Energy project off-campus. Electricity is transmitted to the campus and the university is charged the delivery cost. Excess electricity is sold back to the grid at floating market rate. Similar to the Indirect PPA, Potential Downside Risk exists. This option requires a competitive RFP with 4-6 month of negotiation, and complicated contractual arrangement. The developer is responsible for developing and operating the solar farm.
* The six option is a hybrid approach combining an onsite solar farm and indirect PPA. In this option, we build a 30,000MWh solar farm at UIUC campus. The 30,0000MWH will be consumed on UIUC on campus and their RECs will be attributed to UIUC. For the remaining 60,000MWhr for UIUC and the entire 80,000MWHr needed for Chicago campus, the University will enter into an Indirect Power Purchase Agreement for a solar farm to be built somewhere within MISO region. The estimated savings for this option for UIUC is about $5M over the 15 year term with NPV of approximate savings of $6.2M. The reason the savings for this option is even bigger to UIUC is that we will be able to consume the entire 30,000MWHr produced on campus and this will result in significant transmission and d delivery cost savings. UIC and UIUC will still partner in procuring and executing the Indirect Power Purchase Agreement and UIC will still be able to achieve the same savings as if the entire 170,000MWh were obtained through Indirect Power Purchase Agreement.

To summarize, the best option economically is the hybrid indirect PPA for $140,000MWh and onsite solar farm for 30,000MWh which will enable U of I to achieve significant savings of about $10.5M. All of those options, with the exception of unbundled RECs, the U of I investment will create new renewable energy generating facility and reduce the carbon footprint. In terms of financial risks, with the exception of purchasing RECs, all the other options have some downside risks when the wholesale market price of selling the surplus electricity at the time it is produced, is lower than the fixed price the University is paying the developer. We feel that the hybrid option meets several goals as the one with great savings potential, adds renewable energy to the regional network, MISO network, which supports our local provider Ameren, and directly increas the capacity of the network we use to purchase the balance between what we consume and what we produce at UIUC. In addition, building another solar farm on campus will demonstrate U of I commitment and leadership on this crucial front.