Fall 2022 iCons Idea Slam – Business of the Energy Transition

Welcome to the Fall 2022 iCons Idea Slam – an engine of creative problem-solving using the iCons Innovation Cycle. This year we focus on the Business of the Energy Transition – the role of private business in triggering the massive transition from a fossil economy to a clean energy future. In particular, we focus on the problem of electrical energy storage and delivery.

We are fortunate to have a start-up company named **florrent** – an emerging leader in the electrical energy storage space doing technical research & development on the UMass Amherst campus – to help us think through this problem. I recently met with one of the founders of florrent – **Joe Hastry**, CFO & COO – to ask him questions about their technology problems and business challenges.

Scott Auerbach [SA]: Hello Joe – thank you for taking this time when I know you're busy raising money. Can you explain the larger energy problem that sets the context for florrent's business plan?

Joe Hastry [JH]: Sure, it's my pleasure. So, the energy storage required on the electric utility grid is projected to **increase five-fold** from current levels by the year 2050 according to the National Renewable Energy Laboratory (NREL). This projected growth in electrical energy storage stems from two big changes coming to our energy system: one related to energy supply, and the other to energy demand. Regarding supply, several state laws have been passed mandating the replacement of electricity from natural gas and coal with renewable sources such as wind and solar. However, these sources are variable (intermittent) because the wind doesn't always blow and the sun doesn't always shine. Then there's the demand side, which is only likely to grow with increasing numbers of electric vehicle (EV) charging stations and greater electrification of building heating systems. As a result, the future electrical grid could experience spikes in unmet power demand – these can lead to electricity outages and all manner of public health problems.

SA: Wow, that sounds like a serious problem. What's the plan for dealing with grid instability?

JH: Currently, lithium ion batteries are considered a good solution for addressing the possible future instability of the electical grid. However, in our conversations with utility officials and grid asset developers, we've learned that in many cases they're not deploying batteries that they know they need for one main reason – cost.

To understand the root of this **problem**, you have to think about the difference between *capacity* and *power* of energy storage. Imagine a battery is like a jug of water; it can hold a little or a lot of water (capacity) and it can have a small spout that pours water slowly (low power) or it can have a large spout that pours water rapidly (high power). In exactly the same way, batteries can have low or high energy storage capacities, and low or high power generation. **The fundamental problem with modern battery technologies is that they have good energy capacities but low power generation**. However, providing electricity during spikes in energy demand requires high power, which places a load on batteries that degrade their usable lifespan and makes them no longer economically viable. So even though they are a good solution to grid instability in principle, in practice today's batteries alone are not enough.

SA: So what's the **solution** here – scrap batteries altogether or combine them with something else?

JH: In our opinion, ultracapacitors (UCs) provide a critical energy storage **solution** when paired with batteries in what is known as a "hybrid energy storage system" (HESS), creating functional and economical solutions that solve the energy release bottleneck and fully enable the energy transition. An ultracapacitor is an energy storage device that's like a battery with low capacity but very high power generation. **Ultracapacitors store 1% of the energy of a battery, but deliver that energy with 1000x the typical power of a lithium ion battery, and over millions of recharge cycles**. This makes these two technologies incredibly complementary, forming a HESS with both high energy capacity and high power delivery that can be applied across major industries / markets to meet necessary decarbonization and electrification goals. We are convinced that deploying HESSs with ultracapacitors will result in (1) more deployment of new storage and less upkeep of existing systems, (2) less "over-deployment" of batteries to meet the base requirements of the system, and (3) more footprint available for increased storage.

SA: Wow – that's quite a vision! Is there anything our students can read to learn more about your vision of ultracapacitors?

JH: Sure, your students are welcome to check out the public version of the **florrent** pitch deck, the powerpoint slides we use for fundraising, which can be found here.

SA: Thank you for sharing these slides. I'm sure our students will love to see how a start-up company tries to sell itself. **[Note to students: That's my way of saying "Hey students, do check out these slides as part of your preparation for the iCons Idea Slam."]**

Now, the fact remains that your vision for the future of HESSs with ultracapacitors – exciting as it is – remains a plan but not yet a reality. What are the hurdles that have to be overcome to make your vision a reality?

JH: Good question; this is what's occupying my mind nowadays. When raising money for a start-up, it's all about convincing investors that we're a low-risk investment. We call this "derisking" – funny name, right? To do this we need to understand the main sources of risk, which for **florrent** are related to our *Manufacturing* and the *Market*.

First is **Manufacturing** – there are two technical issues that need to be addressed to ensure successful (that is, low risk) scale-up of our solution.

A. *Consistency*: Our technical solution utilizes **hemp** as a natural material for constructing ultracapacitors, because of (1) the potential for sustainable sourcing of hemp, (2) the low price of this feedstock, and (3) the superior power performance of our ultracapacitors. However, possible variability of this biomass-derived feedstock as an input into our manufacturing process is a risk. Such is a risk with any bio-derived supply chain. We are working with our network of (BIPOC) farmers to ensure that their regeneratively-grown hemp consistently provides the material properties needed to build ultracapacitors that perform at the required levels.

B. *Commerical Ready*: Optimizing our material to be "drop-in ready" – enabling scaled production through licensing and/or contract manufacturing – is a critical aspect of our technical plan. This includes working with advanced heavy equipment, namely "roll-to-roll"

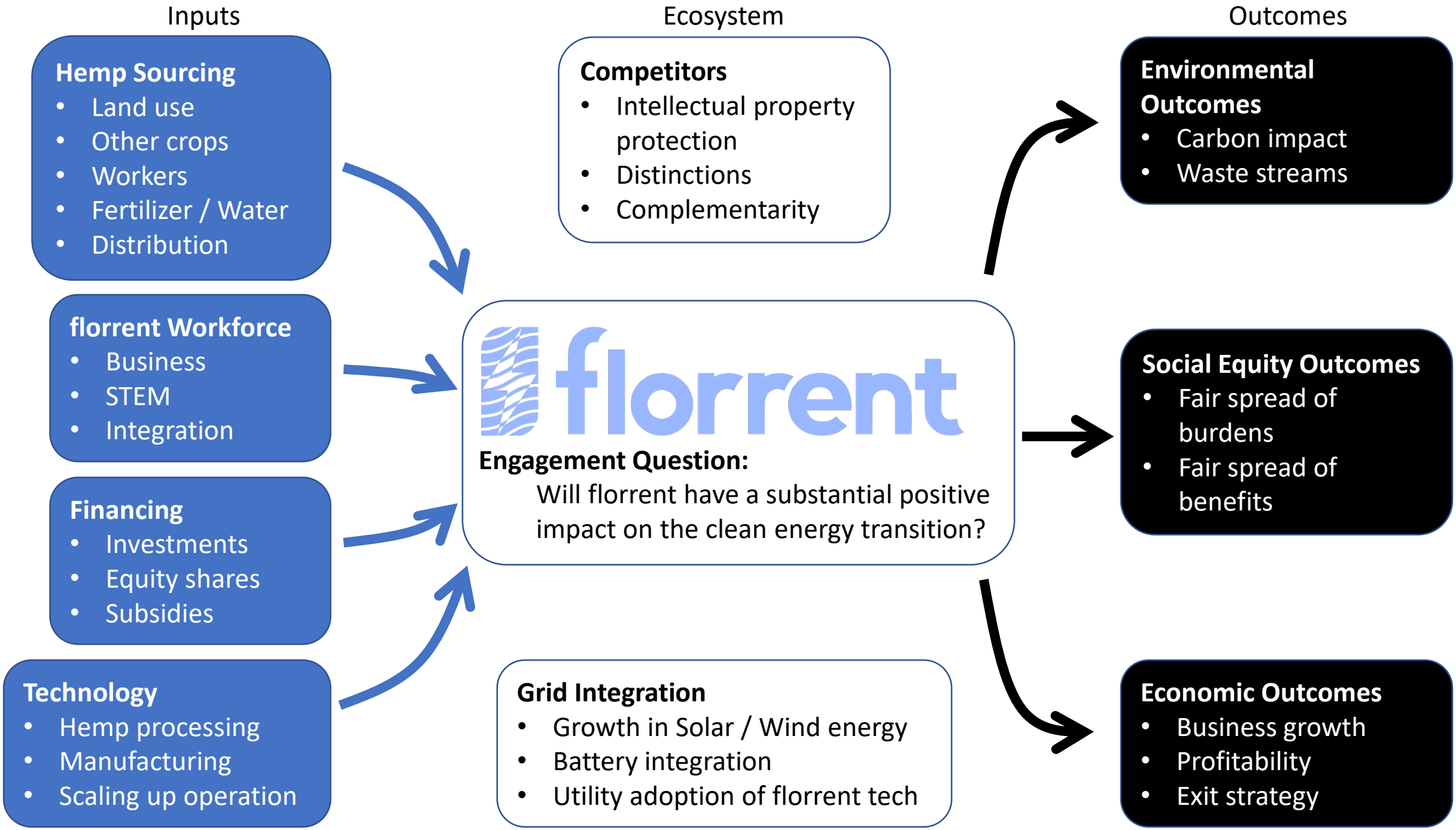
processing machines, to turn our electrode material into industry standard building block cells (the so-called “floCAPs” in our pitch deck). Manufacturing our products in commercial-ready form factors that customers are used to using is critical for integrating florrent Ultracapacitors into existing value chains.

The second source of possible risk is related to the **Market** – distinguishing our solution from the competition. We’re competing against other Ultracapacitor makers in traditional markets, and looking to enter into non-traditional markets that need new storage. Entrenched competitors with deep pockets and a mature supply chain, like Skeleton Technologies and UCAP Power, require us to disrupt the ultracapacitor industry with our hemp-derived solution. Our big competitors make Ultracapacitors using petroleum by-products or coconut-husk derived activated carbon. Protecting our intellectual property (IP) from these existing players will be key in creating our competitive “moat.” Mostly, we need to demonstrate that our solution’s cost, battery lifetime extension, and energy density benefits are large enough deltas to attract demand and convince key stakeholders to change from today’s status quo of lithium ion batteries to the next generation of energy storage.

SA: Thank you, Joe, for sharing all this. I hope you all at **florrent** reach success. I also hope the iCons students help you with some creative ideas from the Fall 2022 iCons Idea Slam !!

Supplemental Reading (optional**)**

- To learn more about **batteries**, check this out.
- To learn more about **hemp farming**, take a look at this.
- To learn more about **ultracapacitors**, hit this link.
- To learn more about the **electricity grid**, see this article.


Inputs
Ecosystem
Outcomes
Hemp Sourcing
Land use
Other crops
Workers
Fertilizer / Water
Distribution
florrent Workforce
Business
STEM
Integration
Financing
Investments
Equity shares
Subsidies
Technology
Hemp processing
Manufacturing
Scaling up operation
Competitors
Intellectual property protection
Distinctions
Complementarity
florrent
Engagement Question:
Will florrent have a substantial positive impact on the clean energy transition?
Grid Integration
Growth in Solar / Wind energy
Battery integration
Utility adoption of florrent tech
Environmental Outcomes
Carbon impact
Waste streams
Social Equity Outcomes
Fair spread of burdens
Fair spread of benefits
Economic Outcomes
Business growth
Profitability
Exit strategy