Cleantech Group

Event Insights

February 2020

Cleantech Forum SF 2020

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Energy & Power Key Takeaways

We are pleased to share with you our key event takeaways from the **Cleantech Forum San Francisco**, held on 27-29 January 2020. The annual event brings together global investors, innovators, corporates, and change-makers looking for answers to the biggest question: who will lead the transformation we're all waiting for?

This year, the theme of the Forum *Welcome to the Chaos of the 2020s: Urgent Actions, Unusual Strategies, Unexpected Allies* echoed the growing pressure to deliver solutions. Topics for Energy & Power included **edge computing** in energy, **smart buildings**, **long-duration energy storage**, and **waste hydrogen**, amongst others.

For any follow-up questions about the event, please contact:
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Energy & Power Digitization and Decarbonization: It's no longer just about the early adopters and targeting lower hanging fruit

Globally we are seeing an unprecedented accelerated pace of low-carbon technology being applied across the energy value chain. In terms of energy investment, 2019 was the highest year in the past six years, with a total of $3.95 billion in investments and 447 total deals over the 12-month period.

From buildings to batteries, the broader decarbonization trend is no longer just about decarbonizing easy/quick markets. Instead, the conversation has shifted towards those industries and assets where carbon is much harder to abate.

It was great to see the broad spectrum of familiar faces at the Forum. However, what stood out most to me over the 3 days was the surge of corporate investors joining our ranks. Incumbents that have been slow to adopt are being forced to innovate, keeping pace with tightening regulation and consumer demand. Aviation corporates, mining incumbents and steel manufacturers globally are waking up to the climate urgency, and unusual strategies between newer market entrants and industry incumbents are becoming more commonplace.

Edge Computing in Energy

Key Takeaway: Edge computing is not another buzzword like IoT and blockchain – it's a new paradigm which can be deployed today.

Edge computing, comically defined by the panel as anything that's not Amazon Web Services, involves processing data as close as possible to the source. The new IT paradigm provides the ability to react in real time, enabling innovations closer to the asset, and bringing real time analytics close to the source of data.

For the energy sector, edge computing can be applied to many applications, including distributed asset management infrastructure and digital substation architecture, and predictive maintenance for wind farms in remote areas (e.g. audio for vibrations). Foghorn, Pixeom (which was acquired by Siemens last year), Energize Ventures and National Grid Partners shared their thoughts on the stage.

The panelists highlighted some key use cases in the energy sector, including Foghorn's example in offshore drilling. Today, flaring conditions are currently monitored/red flagged manually. Foghorn has developed a flare monitoring solution by taking video streams of flare and flagging it real-time.

The market today consists of multiple specific software providers where most are differentiated by application set, but the panel agreed that the market may move towards ecosystem consolidation, where players can be vertically integrated. Many incumbents whose core businesses are asset-heavy companies in the space have these platforms and are keen to build out their data stacks. Today, Japan and Korea lead in terms of edge computing adoption, in part due to their drive to implement lean techniques, where edge has real value for operational efficiencies.

Edge computing sits today at the hype part of the curve. However, the current market features few large-scale deployments. This is a few years away and some challenges need to be overcome. Adopting edge is hindered by cybersecurity concerns, and a higher frequency of edge sensor deployment is still needed. The key takeaway from the session is that edge computing shouldn't be thought of as a new application within IT, but as a new IT infrastructure paradigm altogether.

Smart Buildings

Key Takeaway: It's not just about energy! There is a growing demand for human-centric buildings is taking place to maximize building productivity and comfort.

Given the urgency of climate change, a different kind of thinking will be required over the next 10 years to make buildings more adaptive to the realities of the future. The panelists included Vigilent, VergeSense,

Arbnco and Windsail Capital who discussed how human-centric building solutions are starting to see wider adoption.

Over the past few years buildings have become more equipped with smart IoT sensors and high-speed networking infrastructure. The market has come along a long way in recent years, with new standards, certification requirements and low-emission building mandates helping efforts globally. Today, what is defined as a smart building is very different depending on the user type, ranging from occupant to asset manager to building owner. There are many use cases that have proven profitable. However, on the occupant experience side, it is less developed. Use cases are not personalized and not centered around the occupants. You can't "talk" to hotels as you do to your home. Innovations are primarily focused on maximizing the overall value of a building, which today is a problem. Currently, office buildings have on average 50% wasted space.

Although new AI-driven innovation is helping to maximize building value, there was consensus across the panel that fragmentation still exists along the building supply chain, from design to procurement. These silos between real estate developer, energy stakeholders and the operational team result from a mixture of priorities, ranging from higher productivity to staff retention, happiness to safety. Players across the supply chain need to develop better "blueprints" of how a building is going to be used to develop more cost-effective, valuable solutions.

Long Duration Energy Storage

Key Takeaway: Cater for market requirements, not for incremental energy storage duration improvements.

As renewable energy continues to proliferate, utilities and other grid stakeholder are increasing their requests for large-scale long-duration energy storage solutions that lithium-ion, coal plants and pumped hydro will not be able to satisfy. While lithium-ion is the clear front runner for short-term balancing needs, it was clear that a gap exists for solutions that can deal with multi-day, multi-week and multi-month balancing requirements. The three innovators on the panel, Quidnet Energy, ESS, and Form Energy emphasized that while they are focusing on the "long duration" market, they do not feel they are competing within the same buckets of duration.

The gap in the markets ranges from 4 hours of energy discharge, all the way up to 100 hours. Further more, the requests coming from the grid players range broadly across this spectrum, depending on how fundamental value on a grid system is differentiated. Factors such as energy storage regulation, renewable penetration, off-peak pricing, natural gas cost and policy, peaker plant decommission rate, transmission/ interconnector capacity and capacity market replacement cost are key variables that dictate this current need. BP, the corporate on stage, discussed their view, showing an increasing interest in solutions which go above "daily cycling" and are in the exploration phase to understand the value of the multitude of new solutions coming to market.

One key point from the panel focused on how the demand for long duration storage is going on evolve. Instead of a correlating increase in demand and incremental steps through durations, the products will develop based on what the market needs, and ultimately, is willing to pay for. When it comes to long duration, cost is one of the primary drivers to watch. **Figure 1** below highlights some of the innovators in the space.

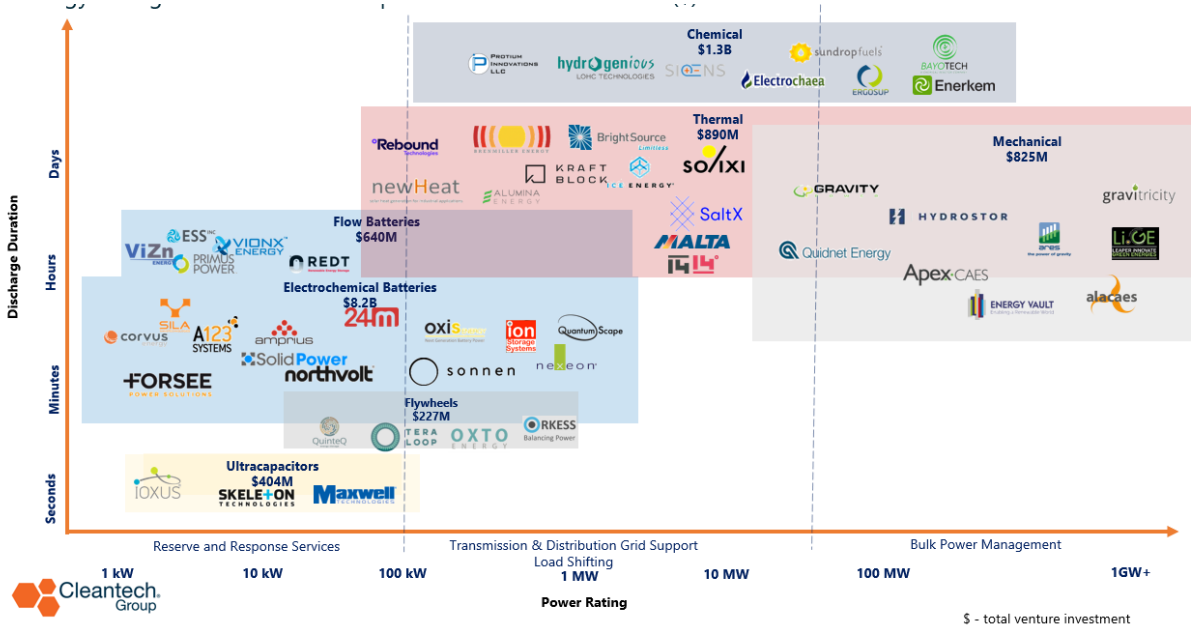

Figure 1 Energy Storage Market by Duration and Power Rating, Cleantech Group

Capture Waste Hydrogen

Key Takeaway: From industrial reclamation, food waste recovery to carbon to hydrogen, cost competitive solutions for obtaining clean hydrogen can be obtained from waste streams.

About 80% of the hydrogen we produce is for a few key major industries: chemicals, refining industry, and applications in metal production, methanol production, food processing and electronics. However, over the past 2 years, there has been an acceleration across all segments of hydrogen with investments into electrolysis and infrastructure build up. This change has come about from a global re cognition from both the private and public sector that hydrogen, if produced from a renewable source, can be used as a green energy carrying-molecules to couple carbon-intensive sectors such as heavy industry, heat, transportation and power generation.

Most efforts in the market have been aiming to drive down the capital costs associated with renewable hydrogen production, which are predicted to become competitive within the next decade when they reach the $2-$3 per kg of hydrogen. However, the session panelists proposed three alternative solutions where renewable hydrogen could be obtained from unfamiliar waste streams.

- Electro-Active Technologies proposed using electrolysis and micro biology to produce hydrogen from food waste at room temperate in one reactor, providing a zero-emission fuel while also offering a solution to food waste. The company is targeting electrolysis costs of $6/kg, which could be driven down given the revenue opportunities for dealing with food waste.
- Skyre is going after the metals markets where hydrogen is used as a product treatment agent. Waste hydrogen is captured using an electrochemical compressor. One initial application is currently being piloted with Shell via the H2 Refuel Accelerator, where Skyre is capturing waste hydrogen form Shell's industrial furnaces, which alone could be a $100 billion market.

- Proton Technologies is targeting depleted oil reservoirs, converting them into hydrogen mines and thermal generators. Hydrogen is produced using combined in-situ gasification and hydrogen selectivity techniques. The company is currently in pilot phase.

Decarbonizing Heavy Industry

Key Takeaway: Industrial incumbents are waking up to CO2, but we aren't fully there yet.

Innovation has accelerated the scale up of decarbonization for the power, buildings, and transport sectors, leading to reductions in costs. Unfortunately, less innovation and cost reduction has taken place for industrial decarbonization technologies. This is a problem as global industrial GHG emissions represent about 24% of all GHG emissions – more than all from transportation and almost as much as from power.

CO2 within heavy industry is a lot harder to abate, making the pathway for reducing industrial CO2 emissions less clear. During the discussion, the panelists from Boston Metal, METRON and OGCI Climate Investments dived into what near-term opportunities the heavy industry sector has to join the global decarbonization transition.

On the software side, advanced energy management can provide improvements that lower fuel consumption by 15% to 20% and can be economical in the long run. The challenge is that most industrial complexes are not "industry 4.0" ready and are risk averse, and therefore a managed service i s generally required to guide customers through digital transformation. By working directly alongside machine providers, facility managers and utilities (who help build new services to sell to industrial clients) , METRON is helping to build dynamic knowledge databases using AI – from a data science and physical model perspective.

Many challenges exist for inefficient systems. Electrification of heat is a heavy hitter when it comes to CO2. Today, electrifying heat production at greenfield cement plants is believed to be even more cost-competitive than applying carbon capture and storage to the emissions from fuel consumption. Boston Metal discussed how their metal oxide electrolysis system is helping to electrify heating systems in the mining industry and steel sector. While difficult to penetrate due to tight operating margins, the steel industry is starting to improve, particularly in Europe, where a 2050 carbon neutral goal has been set. Both Boston Metal's solutions and hydrogen as a feedstock for the steel industry were discussed as potential options.

In additional to industrial energy management and heat electrification, the group discussed how industrial demand response can be a low hanging fruit for decarbonizing industry, and how waste heat recovery technologies also have high potential, particularly in smaller scale applications.

Other Key Sessions

Nuclear: Innovative versions are creating a promising picture for the future of nuclear both from a low carbon and economic standpoint. The 2020s will be a key decade to see if new nuclear can compete as solutions are commercialized.

Low Carbon Fuels: Fuel efficiency in the aviation industry is growing but emissions are still rising. Instead of purchasing offsets, the aviation industry needs to investigate carbon neutral fuels.

Power-to-X: As renewable generation continues to grow worldwide, power-to-x markets have emerged, with technologies utilizing power to create fuels, chemicals, gas, and other products. Large-scale pilots are in the works and the real value will be shown in the coming years.

What's Next?

The **Cleantech Forum Europe** will be **18-20 May 2020 in Luxembourg** to continue the discussion about how disruption and transformation will impact your business.

Register here today to join us!