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Leonard Transportation Center

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Inland Empire Regional Mobility Dialogue Series

Results and Summary

Commercial Electric Vehicles: Volvo LIGHTS Project



Introduction:

As the Inland Empire looks towards the future of transportation and logistics, particularly under the importance of decreasing environmental impacts, the development of electric fleets has been an exciting and important investment. This Dialogue focused on the Volvo LIGHTS project, which aims to introduce electric trucks into real world operations. Specifically, in this Q&A style conversation, we examined the practical and logistical considerations surrounding the charging infrastructure necessary to make the Volvo LIGHTS project a reality. Additionally, this conversation focused on the importance of training and preparing society for the transition to fleet electrification. In this dialogue, we examine what unique challenges are presented by developing technology in this growing industry and what we may be able to look forward to as this technology gains traction and becomes more available within the industry.

Experts in this Dialogue included:

- Dr. Arvind Kailas- Advanced Technology Policy Director, Volvo Group North America
- Rob Crandall- Senior Project Manager, Greenlots
- Ruth Liddell- Project Manager, ABB
- Kim Okafor- Zero Emissions Solutions Manager, Trillium

Major takeaways from this conversation include an increased understanding of the impacts of the Volvo LIGHTS project, the challenges faced in the development and implementation of this new technology, and how charging infrastructure is being developed in the Inland Empire today.

The Dialogue began with a discussion of the Panel Experts' respective technologies, in relation to Volvo LIGHTS. Each of the experts then went on to discuss how they and their companies have been involved in deploying this new technology.

Dr. Arvind Kailas- Advanced Technology Policy Director, Volvo Group North America

Dr. Kailas began the Dialogue by explaining the Volvo LIGHTS project development. He emphasized that the LIGHTS project location in the Inland Empire is key because of port locations and the fact that “innovation is not happening just in Silicon Valley; it is happening right here in the Inland Empire in Southern California.” Dr. Kailas explained that the LIGHTS project has been made possible by the convergence of generous funding and involvement of several key agencies that have been able to make the development of electric trucks a reality in logistics. A total of seven electric trucks are still being developed and tested by Volvo LIGHTS but they are already being used to transport parts between sites in the Inland Empire. It was emphasized that there is so much more to the deployment of this technology than simply building the electric trucks themselves. The development of charging infrastructure is integral to the success of this project and its ability to expand. Dr. Kailas served as both a facilitator and an expert on this panel.



- Senior Project Manager at Greenlots and responsible for installation of commercial EV infrastructure projects across North America.
- Greenlots is powering the future of electric transportation with industry-leading software and services that equip drivers, site hosts, and network operators to efficiently deploy, manage, and leverage EV charging infrastructure at scale.
- For Volvo LIGHTS, Greenlots is providing turn key construction solutions along with hardware, software, and support services.

Rob Crandall- Senior Project Manager, Greenlots

Rob introduced Greenlots by explaining their responsibility for installation of the LIGHTS project, which is made possible by their Sky Communication Network. This network “basically ties in any type of charger manufacturing company that is in the United States and other countries.” Greenlots also works on the consumer side and is responsible for building out the project on-site and training its customers.

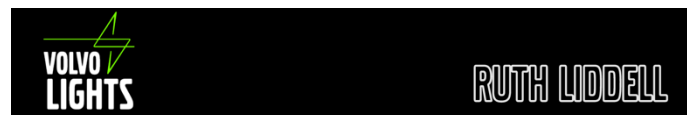
After introductions, Rob then went on to elaborate on the steps that were taken to develop and implement charging technologies. According to Rob, “location is the first key” but dealing with utilities can “make and break your location.” Rob explained that, after designs are developed in the first 2-3 months of project development, then they are submitted to customers for review and then for permitting. According to Rob, “permitting is really more of a waiting period, not so much a challenge.” These permits typically take about 30 days to be reviewed and approved. During the waiting time for permitting, there is a collaboration with utilities as they develop a “final map” of the necessary utility infrastructure for the project. According to Rob, the utility infrastructure has the potential to be a large project expense so it is important to start work with them earlier, rather than later, so there are no surprises that could derail the project. After a location is identified and all the necessary permitting and utilities are established, installation of the infrastructure can take 4-5 weeks. Overall, Rob estimates that the entire project, from development to installation takes about 3 months but can be faster depending on weather conditions.

After the infrastructure is up and running, Rob and his company, Greenlots, set up the communication and commissions for the network. According to Rob, consumers “can control on and off time” of the chargers as well as output loads, which can help customers keep track of utilities costs and customize the network for their purposes. Greenlots also works with customers on training for use and setup of the system and many customers work with the engineering teams for the trucks being used so everything is set up well together.

Ruth Liddell- Project Manager, ABB

During introductions, Ruth reported that she is “responsible for implementation of our high-power charging system in the U.S. as well as some of our aftermarket infrastructure upgrade campaign for North America.” ABB is providing the hardware for the Volvo LIGHTS project, which is primarily the high-voltage charging equipment necessary to fuel a fleet of electric trucks. Additionally, ABB ensures that the hardware works properly and technicians and operators are properly trained on how to utilize such hardware.

After Rob Crandall presented on the details of Greenlots involvement in Volvo LIGHTS, Ruth expanded on the hardware component of the project that her company, ABB, is handling. She began by explaining that the novelty and advanced nature of the electric vehicle technology means that, “every charger is made to order.” The chargers are of extremely high voltage, which is simply not necessary or available for many other projects. Ultimately, development of the chargers takes about 8-10 weeks.



- Project Manager at ABB and responsible for implementation of high power charging systems in the US as well as aftermarket infrastructure upgrade campaigns for North America.
- ABB is a technology leader driving digital transformation of industries including transportation electrification. ABB has 14k+ DC fast chargers, ranging from 50kW to 350kW, across >80 countries worldwide.
- For Volvo LIGHTS, ABB is providing its high-voltage charging technology including the Terra 54HV (50kW) and the HVC 150 Depot Box (150kW). ABB is also coordinating safe installation and commissioning of the heavy duty charging equipment for Volvo's electric trucks.

Ruth went on to explain that an important part of the investment in these chargers is the “operational lifetime” that can be expected from the hardware. Questions regarding downtime of the chargers, ongoing support, and fixing any issues that arise must be considered early and often. Ruth advised, “you always want to make sure you’ve got some supply of spare parts on your side” to reduce downtime if hardware needs replacing. Ruth emphasized an earlier point made by Rob Crandall, which is how important it is to “engage stakeholders as early as possible and make sure you pull that utility.”

Ruth concluded her discussion by calling attention, once again, to the fact that the electric truck and necessary charging industries are new and there is “a lot to learn” even for experts like her and the others on the Dialogue panel.

Kim Okafor- Zero Emissions Solutions Manager, Trillium

To open, Kim explained that, at Trillium, she is responsible for projects centered around electrification at Volvo LIGHTS, but she also works on projects that utilize alternative fuels, such as hydrogen and solar energies. She reported that the Volvo LIGHTS project will be the “first publicly accessible heavy-duty charger” that the company has developed.

After Ruth Liddell presented, Kim talked about the differences between public charging stations and private charging sites. She began by stating that a specific challenge of developing public charging sites that will impact design of the site: the “number of different types of vehicles that could come to your station.” There are many considerations that come with an unpredictability in traffic to the site, including a calculation of vehicle turn radiuses, building out necessary passing lanes, and ensuring there is generally



- Zero Emission Solutions Manager at Trillium and responsible for the EV business across North America. This includes the development, implementation, and maintenance of EV infrastructure.
- Trillium is a leading alternative fuels provider with design, build, operation, and maintenance capabilities.
- For Volvo LIGHTS, Trillium is providing the first publicly accessible station to charge electric trucks.

enough available space for the many different types of vehicles using the site. Kim also explained that the Volvo LIGHTS station is going to be built on the same site where there is existing compressed natural gas (CNG) fueling, thus, adding EV charging will impact existing customers.

Kim concluded by reiterating the importance of planning as early as possible in these projects – not much different than that of private sites.

Questions for the Panel presented by Dr. Kailas

After each panelist presented, Dr. Kailas prompted the group to elaborate on how coordination works and what it looks like for the teams involved in the Volvo LIGHTS project. Ruth began by discussing the fact that she and her team are having weekly meetings regarding the project because “things can change so quickly in a project.” This required a trained technician to assist with hardware installation to ensure the project timeline is not extended due to training issues. They also work with Greenlots to ensure that the software and hardware of the chargers work as planned. Ruth emphasized that, “we want to get it up and running as soon as possible and use those chargers,” so they are committed to engaging often in meetings to make that happen as quickly as possible. Rob echoed this sentiment and reiterated the importance of weekly meetings in the success they have had so far, stating, “these units commission very well. We don't have any surprises. We don't have any major upsets. It's just been a pleasure to work with ABB on this.” Kim added that the development of the Trillium public charging station has been made possible by the foundation of quality coordination between Greenlots and ABB. There continues to be coordination for their project on building appropriate infrastructure for a public charging station and accommodating both light and heavy-duty vehicles in the same space.

Dr. Kailas presented a second prompt, regarding the biggest regulatory or policy hurdles that have been faced throughout these projects. Rob began by stating that, “one of the biggest policy hurdles is basically permitting, working with cities. Electric vehicle charging scares people when they actually start talking about the large fleet charging facilities that we're installing. It just brings up a red flag in their mind. And they think they have to really do their due diligence. Which of course they do, to verify what you're installing and that they understand what is being installed because it's so new. So, that is probably the biggest hurdle that we deal with, just kind of educating people along the way.” For Ruth and ABB, there has been a hurdle of transitioning technology already available in Europe, the CCS2 cable, and bringing it to the US under appropriate code regulations. Lastly, Kim educated the group on “something called Rule 18 that's within Southern California Edison territory. And really what it says is that we cannot resell electricity to heavy duty or medium duty trucks as a fuel. This Rule only allows for the resale of

electricity for light duty vehicles. So, we're actively going through the changing of this Rule. So thus far, that's the biggest regulatory challenge. And quite honestly, we haven't made it through yet."

The panel concluded with their major takeaways from the project. Ruth stated that, "I think I really want to reiterate that it's new technology, a new industry, so there's going to have to be some patience. Things aren't readily available. You're not going to be able to start and finish a project in a month. So, having that patience and understanding is very important." Kim went on to share that "you need a group of partners in order to make this type of initiative go" and that it is important to "get an idea of how the public feels, because there is not a public network yet. So, having a group of experts discuss these issues, such as we did today in this Dialogue, is needed to get the industry off the ground." Lastly, Rob explained that, for him, a major takeaway was the simple learning curve of how the truck technology worked and the practical engineering, the customer service, and the simple measurements necessary for the hardware and software to work together properly.

Round Table Q & A

After the presentations and questions posed by Dr. Kailas, Kimberly Collins presented several questions that were submitted by Dialogue attendees for the Panel to answer.

Question One:

From James Shankle: Who maintains the charging station after it's sold and who pays for the electricity?

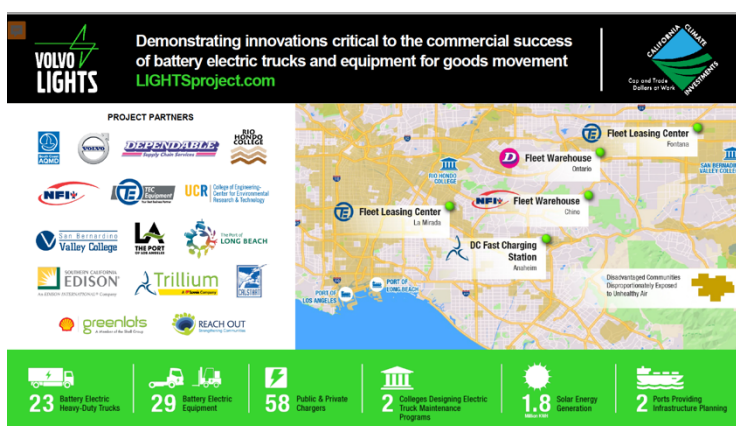
Rob first answered by stating that

"Greenlots offers an O&M package to maintain the chargers for any length of time," which can be either onsite physical maintenance or remote assistance. Ruth followed up and added "these chargers have dual uplink, meaning that all of the diagnostic data is sent to Greenlots and then also sent to ABB so that we both have the ability to review it. This allows us to analyze and understand what's happening with the charger. If there's an issue occurring, we work to troubleshoot it remotely and then obviously, send a technician out if necessary." Ruth emphasized the importance of having access to spare parts onsite to address any hardware issues quickly. Kim finished by stating that, in her case, "the maintenance and the operation is done by Trillium and the electricity bill is paid for by Trillium."

Question Two:

What factors do you consider when deciding about the location of the chargers and what kind of analysis do you use for such decision making?

Rob began by stating that the logistics regarding truck turn radiuses and accessibility are considered within a site, but there is also a concern for overall location of the site relative to existing utilities so that these large services are able to be installed with new infrastructure that can support them. Kim followed up on the importance of location by sharing that, for the public stations, general location in the Inland Empire between ports and major transit hubs was key. Additionally, to expand upon Rob's point regarding spatial concerns within sites, Kim said, "the way that we will be doing our charging at our station is very similar to a gasoline station or a diesel station where it's a pull through type of configuration. And that was very intentional because of the difficulty that comes along with parking a medium and heavy-duty truck."



Question Three:

Are there any safety concerns for high-powered chargers? And what is the liability?

Kim answered this question first by stating that, in her case, the approach would be similar to traditional gasoline stations. She elaborated, “if, for instance, we didn't install the charger correctly, we didn't put in a circuit breaker, we didn't get the transformer installed correctly from the utility, and something happens that's on us. But if it's misused by the user, then that's something that would land some of the liability on the user.” She also commented that companies like ABB “know all of the safety implications and the design measures that need to be put in in the infrastructure in order to make the station safe.” That knowledge is additional to what the industry has learned from the electrification of light-duty vehicles and has helped understand the necessary safety measures in these kinds of projects. Ruth followed up by stating that despite some concerns that people may have about the safety of these chargers, they are already being used at similar wattage throughout California without issue. Additionally, there are built-in safety components in the chargers that prevent them from receiving power if there is any kind of malfunction. From her perspective, safety is an understandable concern but a non-issue.

Question Four:

How about inductive charging?

Rob began by stating “Inductive charging is going to be a little tough...because there's power loss between inductive charging pads and the vehicle itself. So, I think we're a way off from that.” Dr. Kailas followed up by saying, “there's a lot of practical considerations that need to be taken into account, not just the technology, but the other side of things. We have to kind of look at the customer and see if they're at their warehouse or cross dock or wherever they want to install the chargers, assuming where the trucks are either parked or domiciled or idling that can actually accommodate these inductive charging hardware.”

Question Five:

How long does it take to charge one of these vehicles?

Dr. Kailas answered by saying “what you're going to see is you're probably not going to use the truck chargers the way you do car chargers.” There is no specific answer, but it is likely that many users will be using fast charging to top off their power. This can also be impacted by the state of the battery and the distance being traveled. A follow up question by Dr. Collins regarding distance traveled and supply chain impacts was again answered by Dr. Kailas. He stated that this can be addressed during development and there is an education piece with the customer regarding their operational needs, distances to be traveled, and how to extend range through things like battery packs.

Questions Six:

Are there similar initiatives underway in other areas of the country?

Dr. Arvind explained, “Volvo LIGHTS is very unique because it brought together about 16 different partners, unique collaboration between the public sector and the private sector. But it goes back to 2018 where CARB, the California Air Resources Board, had a proposal under zero or near zero emissions freight facilities program. This is a publicly funded project of 90 million dollars, 50 percent of that comes from CARB. So, to us, it tells us that incentives are absolutely critical when you're thinking about advanced technologies, not just the vehicles site, but also the infrastructure site.” He shared that CARB has funded a few other projects and that the incentives provided by funding have driven the technology.

Questions Seven:

What do you see the future being for heavy duty electric vehicles?

Kim shared that she believes there will be a move towards “a mixture of two different types of fuels. I think it's going to be a little bit of hydrogen and a little bit of electric,” especially depending on location and distance to be traveled. Ruth followed and explained that the direction of this technology will be dependent on how it is being used, particularly regarding scaling. Additionally, there are going to be explorations of how to power these vehicles, potentially in large numbers, without pulling from the power grid. Ruth finished by stating that, “the creative solution is what we're going to start to see after we take these pilots, you know, figuring out where we can get our energy in and making sure that it is clean energy.” Lastly, Rob added to Ruth’s point by saying that, “we work with the customer and there are partners that are solar contractors. So, we all work together as part of a group to install solar and battery storage if possible.”

Moving the Dialogue Forward: Ideas from the Participants

After the presentations, the Dialogue attendees discussed the ideas presented and worked together in groups to discuss solutions to move it forward. The top three ideas from each table have been categorized and summarized below.

Adapting and Overcoming Barriers. Several participants discussed the barriers that may be present to implementing this technology and what addressing them might entail.

- Streamlining regulatory processes
- Making improvements to the process over time
- Foreseeing issues before they develop and working to prevent impacts
- Breaking down silos and promoting collaboration across business and private sectors

Community Education and Investment. Most groups identified a lack of community education and the fact that many people are inherently uncomfortable with their perception of this technology as an issue that needs to be addressed.

- Educating the public on this technology and its benefits through continued conversations, forums, and open communication.
- The importance of public leadership in providing support and incentives for these technologies to be developed and implemented.

User experience. The groups also discussed the importance of making sure the technology is easy to use at the consumer level.

- Developing training programs so consumers are properly educated on the technology and how to use it
- Ensuring that users are supported through any technical difficulties.
- Configuration of facilities in practical and efficient ways so they are accessible and easy to use.

About The Regional Mobility Dialogue Series

The Leonard Transportation Center (LTC) at California State University San Bernardino (CSUSB), presented a bi-monthly dialogue series on topics relevant to the future of transportation in the Inland Empire. The series, which was open to the public, was sponsored by HNTB Corporation and was held every other month starting in February 2018.

Dialogue topics ranged from understanding the current mobility dilemma and its causes to potential solutions like congestion pricing, transit; emerging technologies such as autonomous and connected vehicles and new ways of funding transportation infrastructure. Attendees had the opportunity to hear from transportation experts and engage in vigorous discussion about the transportation challenges facing the Inland Empire.

About Leonard Transportation Center

The Leonard Transportation Center (LTC) at California State University, San Bernardino opened in 2006 with a focus on regional transportation needs. The vision of Bill and Barbara Leonard was to create a center that focuses on the unique transportation opportunities and challenges the Inland Empire faces. Today, the LTC is working to expand its research and student engagement programs. Focal points include transportation management and governance issues, development of new technologies, and transnational studies. Their vision is to work collaboratively to seek solutions to assist residents, businesses, government and nonprofit agencies, and international partners to work together on improving sustainability and quality of life in the Inland Empire. For more information, visit www.csusb.edu/ltc

About HNTB

HNTB Corporation is an employee-owned infrastructure solutions firm serving public and private owners and contractors. HNTB's work in California dates back to its founding in 1914. Today, HNTB continues to grow in size and service offerings to clients in California from seven office locations, currently employing more than 350 full-time professionals. With more than a century of service, HNTB understands the life cycle of infrastructure and addresses clients' most complex technical, financial and operational challenges. Professionals nationwide deliver a full range of infrastructure-related services, including award-winning planning, design, program management and construction management. For more information, visit www.hntb.com

About San Bernardino International Airport

Conveniently located in the heart of the Inland Empire, close to major freeways and just 60 miles from Los Angeles, San Bernardino (SBD) International Airport is strategically positioned to meet growing aviation activity, including cargo, business aviation, general aviation, and commercial airlines by providing competitive rates for aviation companies and local businesses looking to stretch their wings and expand their horizons. With extensive stretches of pristine runway and acres of prime land available for aviation development, SBD International Airport is ready to help our community and region reach new destinations. For more information, visit www.sbdairport.com

About San Bernardino Valley College

San Bernardino Valley College will become the college of choice for students in the Inland Empire and will be regarded as the alma mater of successful, lifelong learners. We will build our reputation on the quality of our programs and services and on the safety, comfort, and beauty of our campus. We will hold both our students and ourselves to high standards of achievement and will expect all members of the college community to function as informed, responsible, and active members of society. For more information, visit www.valleycollege.edu