Workshop on Future of DC Distribution Systems for Stationary and Mobile Applications

Day 1: Wednesday October 2nd **Conference Room: NREL IBRF Building**

Start	Item
8:15	Participants Check in at NREL East Security Entrance for Shuttle to IBRF Conference Rooms at NREL & Breakfast
9:00	**Welcome – Context for the Workshop and Agenda Review.** • NREL: *Andrew Meintz* and *John Farrell* • Eaton: *Brian Carlson* and *Calvin Zhang* • Introduction to Workshop: *Vijay Bhavaraju*
9:30	**Panel 1 - Current State-of-the-Art of Stationary DC Distribution** Moderator: *Xin Zhou* 1. DC Distribution and Protection in Industrial Applications – *Florian Schroeder* (Eaton) 2. EV DCFC Systems – *Vic Shao* (DC Grids) 3. Architectures for EV DC Charging – *Andrew Meintz* (NREL) 4. Status of MVDC Technologies – *Prasad Kandula* (ORNL) 5. DC for Datacenter – *Vijay Bhavaraju* (Eaton)
10:30	**Panel 1: Interactive Conversation** All Participants
10:50	Coffee Break
11:10	**Panel 2 - Current State-of-the-Art of Mobile DC Distribution** Moderator: *Kevin Walkowicz* 1. Army Onboard Vehicle DC Systems – *Aric Haynes* (GVSC) 2. Onboard Power Distribution & Protection – *Mark Van Wingerden* (Eaton) 3. Shipboard DC Architecture – *Gunner Sanders* (Cardinal Engineering) 4. More Electric Aircraft DC Systems – *Armen Baronian* (Eaton)
12:10	**Panel 2: Interactive Conversation** All Participants
12:30	Lunch break
1:30	**Panel 3 - Technical Challenges in DC Distribution Architectures - Stationary and Mobile** Moderator: *Sudipta Chakraborty* 1. EV Charging Infrastructure Design – *Chris Rogge* (Black & Veatch) 2. Heavy Duty EV Site Development – *Victor Atlasman* (WattEV) 3. MVSST – *Adel Nasiri* (University of South Carolina) 4. High-Power Electric Vehicle Charging Hub Integration Platform (eCHIP) – *John Kisacikoglu* (NREL)
2:30	**Panel 3 - Interactive Conversation** All Participants
3:00	Break
3:20	**Panel 4 - Technical Challenges in DC Solid State and Hybrid Breakers – Stationary and Mobile** Moderator: *Andy Rockhill* 1. Fuses for DC Protection – *Robert Douglass* (Eaton) 2. Solid State and Hybrid Switches for DC – *Florian Schroeder* (Eaton) 3. Metering for DC – *Praveen Sutrave* (Eaton) 4. Devices for Solid State and Hybrid Breakers – *Faisal Khan* (NREL)
4:20	**Panel 4: Interactive Conversations** All Participants
4:50	**Closing comments/Summary – Calvin Zhang / Brian Carlson**
5:00	**Adjourn**
5:30	**Travel to Dinner**
6:00	**Eaton Hosted Dinner**

Day 2: Thursday October 3rd **Conference Room: 14142 Denver West (First Floor)**

Start	Item
8:30	Meet at NREL's FLATIRONS campus and check-in (Address: 19001 W 119th Ave, Arvada, CO 80007)
9:00	FLATIRONS Campus tour starts
10:30	End of tour
11:30	**Eaton Colleagues Only: Meet at 14142 Denver West Parkway** Welcome –*Brian*, *Calvin*, and *Mark*
11:45	**History of DC within Eaton & Goals for Today** History of PCS Business wrt. DC – *Brian Carlson* • How the scope of products was decided • The breadth of their product offerings History of Aerospace Business wrt. DC – *Armen Baronian* • How the scope of products was decided • The breadth of their product offerings Goals for today – *Mark Roser* • Identifying possible customer targets • Aligning with possible Eaton technology solutions • Delivering a prioritized list of new businesses in the DC distribution
12:05	**Review Day One (Paper and post-it note activity with Whole Group)** • Identify any indicators that have shifted our view of major trends (Changed, competitive shift or made more clear) • SWOT Analysis of Strengths & Weakness • Identify indicators that have shifted our view of product requirements o New understanding of performance thresholds / requirement levels • Identify gaps in our innovation portfolio • Technologies that we need to still invent or source What is happening in Europe that is not happening in US yet?
12:45	Lunch break
1:30	**Market Review (Columns)** • Introduction to DC Market Areas – *Rakesh Krishnamurthy* • Will review the use cases: • Who are key customers • Who are key competitors • EVCI • Data Centers • DC Micro Grids • Mobile / Vehicle • Aerospace • 10 Minute Q&A from the audience • Question and Answer • Capture key points on post-its for capture • Perspectives on Future Market and Eaton Customer Activities in DC • Stationary – *Florian Schroeder* • Mobility – *Mark Van Wingerden* (Auto) and *Armen Baronian* (Aero) • 5 minutes to identify current status and top 3 priorities for the year ahead for future of DC • 20 Minute Q&A from the audience • Question and Answer Capture key points on post-its for capture

2:15	**Product / Technology Update and Review (Rows)** Panel discussion – Eaton Stationary and Mobile Technology Areas Each member below will have 5 minutes to: • Introduce current DC products • Introduce their current DC Research • Identify the top 3 priorities for the year ahead for the future of DC Product areas: • DC Contactors – *Adam Krug, Charles Tahara* • DC Breakers – *Xin Zhou, Sandy Jimenez, Praveen Sutrave* • DC Fuses – *Luis Valeiron, Robert Douglass* • Integrated Solutions (PDU) – *Mark Van Wingerden, Armen Baronian*, *Florian Schroeder* • Protection Integrated Converters – *Matt Busdiecker, Charles Tahara, Goran Mandic* 30 Minute Q&A from the audience Question and Answer
3:30	Coffee break
3:40	Group transition - organize to 5 separate tables: • Organize into corners of the room Introductions between group members • Members share their knowledge of what Eaton is doing in the area
3:50	Creating Initial Research Ideas: (Goal of 2 to 6 ideas from each group) • Capture current status of Eaton products & research • State the highest priorities for short and medium terms • Research plan to address key unknowns (Example template will be provided) • Key technical research (pursue the weakest links) • Key market research (quantify the opportunity) • Key competitive research (clarify the architecture and trends in the market)
4:50	Group Sharing: • Each team shares the highlights of their work • Q&A from the whole group Group evaluates the talks at the end of each team presentation • Rapid voting, based on: Market Opportunity, Technical Risk, Eaton Alignment
5:20	Wrap-up and Adjourn
6:30	Hosted Group Dinner

Day3: Friday October 4th Conference Room: 14142 Denver West (First Floor)

Start	Item
8:00	Breakfast – Participants check in at 14142 Denver West Pkwy Building
8:30	Converging on the most important topics • Results from Day 2 voting are shared • Overlaps are addressed Each group selects one (or two) topics to pursue in greater depth

9:00	Creating Detailed Plans for Selected Topics (template will be provided):
	• Current status provided by each of the break-out teams
	  • Identify current Eaton programs underway
	  • Identify market requirements
	  • Identify technical performance requirements
	  • Identify preferred architecture
	  • Identify key unknowns = what we have we NOT reached critical understanding
	  • What do we need to monitor (“Sentinels”)
	• State the highest priorities for the short and medium terms
	  • What are the key priorities for Eaton success?
	• Strategy for product development
	  • Key technical research (pursue the weakest links)
	  • Key market research (quantify the opportunity)
	  • Key competitive research (clarify the architecture and trends in the market)

10:30	Final group sharing: • Each group shares highlights of their strategy (3 minutes)
11:15	Next Steps • Sharing and next steps
11:30	Adjourn
11:30	Lunch at 14142 Denver West
12:15	Travel to NREL for visit to ERL lab demos
12:30	Arrival at NREL & badging check-in at gate Walk to ESEF
1:00	Eaton / NREL Labs visits and demos
4:00	Adjourn

Tour to Eaton / NREL Labs on October 4th:

	Group 1	Group 2
01:00 – 01:30 PM	SETO project – NREL SPL	V2X Demo – Eaton lab
01:30 – 02:00 PM	V2X Demo – Eaton lab	SETO project – NREL SPL
02:00 – 02:30 PM	NREL EVRI Lab	DC4EV Demo –Eaton lab
02:30 – 03:00 PM	DC4EV Demo –Eaton lab	NREL EVRI Lab
03:00 – 03:30 PM	EDAMS project–Eaton Meeting Room	