WEBINAR

"Low Voltage Direct Current (LVDC) and DC Technologies:

Potential applications for a clean energy transition"

Dates:

Monday 8, Tuesday 9, Wednesday 10 November 2021, 09.10 ÷ 12.30

The **European Green Deal** aims at climate neutrality by 2050 to transform the EU into a modern, resource-efficient and competitive economy. It covers all sectors of the economy, in particular transport, energy, agriculture and infrastructure, but also others such as ICT, for example. The energy sector is involved in all the aspects that can contribute to this aim, including DC technologies.

We are living in world of equipment - from generation to loads –, which is, for a wide part, based on Direct Current (DC), yet they are interconnected by means of Alternating Current (AC). In fact, renewables such as PV panels generate DC (Direct Current) or need a double conversion AC/DC/AC, such as wind turbine generators, to meet the AC grid quality requirements. On the consumption side, most of the loads are in DC (computers, cell phones, radios, TVs, LEDs, etc.). Furthermore, storage components as batteries and supercapacitors have a DC character. The need to convert the DC energy generated in AC and then back in DC in the loads is due to the AC nature of distribution systems in the cities and in the houses. AC transmission and distribution systems are in place since the war of current between Tesla – Westinghouse and Edison, more than 120 years ago. At that time, AC transmission proved to be more efficient and cost-effective than DC. This was due mainly to the ease of transforming the electrical parameters of the power by means of a simple and economic AC machine - the transformer - contrarily to DC. Today, with the significant development of Power Electronics (PE) in the last decades, the DC conversion can be achieved efficiently as it happens in AC. In addition, the conversion process can be implemented with a series of peculiarities providing increased grid management flexibility, which can not be provided by the transformer.

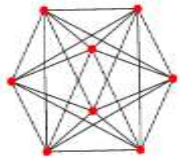
In this context, the use of DC for the distribution grid[1] appears as a viable option. The advantage would be to avoid the double conversion, which, even if it has become highly efficient thanks to PE, represents a loss summing up all the conversions involved in the electrical system. Nevertheless, there are some technical, regulatory, standardisation issues that need to be addressed. It is a challenge but can be taken as an opportunity to evaluate the use of new technologies and systems in support of the clean energy transition.

The aim of the webinar is to:

- Take stock of the actual development and the potentialities of applying LVDC technologies in the actual electricity grid and in homes;
- Identify the barriers (technical, regulatory, standardisation) for further development;
- Collect input/recommendations for further actions.

This workshop builds on the DC – AC/DC hybrid grid workshop of 17.05.2018, where one of the main conclusion was to address separately and systematically the different voltage levels to target appropriately the intrinsic specificities of each.

[1] For long distances, DC is used for transmission (HVDC)



WEBINAR
"Low Voltage Direct Current (LVDC) and DC Technologies: Potential applications for a clean energy transition"
08, 09, 10 November, 2021

Monday, 8 November 2021 09.10 ÷ 12.30
Session I: LVDC technologies and systems – State of affairs
Part I - Overview of LVDC technologies and systems
Panel session I – Which DC technologies and systems can have an impact on the clean energy transition?

Tuesday, 9 November 2021 09.10 ÷ 12.30
Session II: LVDC technologies and systems – Potential development and applications
Part II - LVDC applications
Panel session II – Which DC applications can have an impact on the clean energy transition?

Wednesday, 10 November 2021 09.10 ÷ 12.30
Session III: barriers, needs for further development & EC role
Part III – Cases of LVDC technological, standardisation, regulation challenges
Panel session III – LVDC systems: developments, barriers and way forward

Session I: LVDC technologies and systems – State of affairs			
No.	**Time**	**Description**	**Speaker**
1.1	09.10 ÷ 09.25	Welcome and introduction	Vincent Berrutto, Head of Unit B5 - Innovation, Research, Digitalisation, Competitiveness, EC, DG ENER
	Keynote		
1.2	09.25 ÷ 09.45	Challenges and Opportunity of DC Microgrids based on Cognitive Power Electronics	Bernd Wunder, Fraunhofer Institute for Integrated Systems and Device Technology, Germany
	Part I - Overview of LVDC technologies and systems		
1.3	09.45 ÷ 11.00	DC microgrids and their hierarchical control	Josep M. Guerrero, Aalborg University, Denmark
		DC-Microgrids: opportunities & limits	Christoph Ellert, HES-SO Valais-Wallis, Switzerland
		LVDC grids and control	Giel Van Den Broeck, DCINERGY BV, Belgium
		LVDC Hybrid and solid-state circuit breaker Technology	Michael Bartonek, Eaton, Austria
		5' break	
		Building-integrated DC microgrid	Manuela Sechilariu, Université de technologie de Compiègne, France
		DC-INDUSTRY: Consortium, voltage bands and applications	Hartwig Stammberger, Eaton, Germany
		Technical specifications of an LVDC system for public power distribution	Tero Kaipia, Zero Hertz Systems Oy, Finland
1.4	11.00 ÷ 11.15	Coffee break	
	Q&A on Part I and Panel session I – Which DC technologies and systems can have an impact on the clean energy transition?		
1.5	11.15 ÷ 12.15	• European potential for LVDC developments • The potential of modularity of LVDC systems • Barriers (technical, regulatory, standardisation)	**Panellists:** Bernd Wunder *Josep M. Guerrero* *Christoph Ellert* Giel VAN DEN BROECK

		• Role/maturity/applicability/scalability of new DC Technologies/devices in the grid • Horizon Europe	Michael Bartonek *Manuela Sechilariu* Hartwig Stammberger *Tero Kaipia* *Moderation: Mario Dionisio EC, DG ENER*
1.6	12.15 ÷ 12:30	Conclusions and next steps of Session I	Mario Dionisio EC, DG ENER

Session II: LVDC technologies and systems – Potential development and applications			
No.	**Time**	**Description**	**Speaker**
2.1	09.10 ÷ 09.25	Recap of previous session	*Andrea Feltrin EC, CINEA* (tbc)
2.2	09.25 ÷ 09.45	DC grid planning tools	Antonello Monti, RWTH Aachen University
	Part II - LVDC applications		
2.3	09.45 ÷ 11.00	Power flow and protection of LVDC	Pavol Bauer, Delft University of Technology, the Netherlands
		Power Electronics and LVDC grid Stability	Rupp Stephan, Maschinenfabrik Reinhausen gmbh, Germany
		LV-Engine – an innovation project integrating solid state transformers and protecting LVDC connections	Graeme Burt, University of Strathclyde
		DC-INDUSTRIE grid management	Timm Kuhlmann, Fraunhofer IPA in Stuttgart, Germany
		5' break	
		Simulation tool for techno-economic analysis of hybrid AC/DC Low Voltage Distribution grids	Nina Fuchs, Austrian Institute of Technology, Austria
		EU funded project Hyperride	Gerhard Jambrich, Austrian Institute of Technology, Austria
		Public LVDC distribution in Finland – state of the art and experiences from pilots"	Tero Kaipia, Zero Hertz Systems Oy, Finland
2.4	11.00 ÷ 11.15	Coffee break	
	Q&A on Part II and Panel session II - Which DC applications can have an impact on the clean energy transition?		

2.5	11.15 ÷ 12.15	• DC supply and circuits readily available in the market • What can be done to foster LVDC • Regulatory dimension • Barriers (technical, regulatory, standardisation) • building codes on DC equipment • 'DC-ready' label • EC role (funding instruments)	**Panellists:** Alberto Dognini, RWTH Aachen *Pavol Bauer* *Graeme Burt* Timm Kuhlmann *Nina Fuchs* *Gerhard Jambrich* *Tero Kaipia* *Moderation: Andrea Feltrin EC, CINEA (tbc)*
2.6	12.15 ÷ 12:30	Conclusions and next steps of Session II	Andrea Feltrin EC, DG ENER

Session III: barriers, needs for further development & EC role			
No.	**Time**	**Description**	**Speaker**
3.1	09.10 ÷ 09.25	Recap of previous sessions	PAUNESCU Mugurel George, EC, DG ENER
3.2	09.25 ÷ 09.45	LVDC projects in ECSEL	Ignacio Francisco (ECSEL)
	Part III – Cases of LVDC technological, standardisation, regulation challenges		
3.3	09.45 ÷ 11.00	A Power Electronics Control and Stability Perspective in LVDC	Paolo Mattavelli, University of Padova, Italy
		DC microgrid for EV integration	Maria Dicorato, Politecnico di Bari, Italy
		DC homes	Pavol Bauer, Delft University of Technology, the Netherlands
		DC grids. Measurements and Quality of Service	Mihaela Albu, Politehnica University of Bucharest
		5' break	
		DC protections in industry	Karl-Heinz Mayer, Eaton, Germany
		LVDC pilots in the Netherlands, LVDC product/protocol developments, DC standardisation and market/commercial issues	Harry Stokman, DC Systems, the Netherlands
		Experiences with LVDC last mile pilots in Finland DSO grids	Pasi Peltoniemi, LUT University, Finland

3.4	11.00 ÷ 11.15	Coffee break	
	Q&A on Part III and Panel session III – LVDC systems: developments, barriers and way forward		
3.5	11.15 ÷ 12.15	• What can be done to foster LVDC • Regulatory dimension • Barriers (technical, regulatory, standardisation) • EC role (funding instruments)	**Panellists:** Ignacio Francisco *Paolo Mattavelli* *Maria Dicorato* *Pavol Bauer* *Mihaela Albu* *Karl-Heinz Mayer* *Harry Stokman* *Pasi Peltoniemi* *Moderation: PAUNESCU Mugurel George, EC, DG ENER*
3.6	12.15 ÷ 12.30	Conclusions of the webinar and next steps	Mark Van Stiphout, Deputy Head of Unit B5 - Innovation, Research, Digitalisation, Competitiveness, EC, DG ENER