Q & A Webinar with title:
E Lunch Webinar "DC systems in practice. This is how you do it."

KIVI E-lunch webinar on July 09, 2025:

KIVISpreker1 is started recording in the cloud 11:59 u.

Speakers:

Dr. Ir. Pavel Purgat | Global Applications Engineer | ABB (ELSP)

Pavel Purgat received his M.Sc and Ph.D. degrees in electrical engineering from TU Delft in 2016 and 2020 respectively. He has held various product and business development positions at leading manufacturing companies and research institutes.

Currently, he is at ABB Smart Power with the global application team responsible for the development of the emerging DC applications and applications in the field of battery and hydrogen energy storage.

Questions:

1. What is the difference between the cost for the safety devices between AC and DC?

   - In general there is not a significant difference between AC and DC protection devices. The difference comes with the technology; the fuses and the electromechanical circuit breakers and the solid-state solutions like e-fuses or solid-state circuit breakers will have different cost ranges.

2. How do you know if semiconductor can survive the I2T generated from the grid or the source? or is it the intend to replace the semiconductor after a short circuit?

   - The semiconductor in the circuit breaker is rated for a certain critical rate of rise of current. Under these conditions, the semiconductor always opens at the same (almost) let-through current. The i2t rating, Icw, or Icu is not a significant design parameter for solid-state circuit breakers due to their fast operating speed.

3. How do you achive section discrimmination upsteam if you use ultrafast switching or is here a different design thought applicable here if so can you explain?

   - Achieving selective operation between solid-state circuit breakers with the same or similar ratings is challenging and normally relies on high-speed communication (e.g., closed ring topologies on vessels). When the circuit breakers have significantly different ratings, the selective operation could be achieved also without the communication.

4. How to maintain the Infinitus SSCB? Let's say after 5 and/or 10 years.

   - There are three main parts that require maintenance. The liquid cooling circuit, the electromechanical switch, and the power electronic switching unit. The longest maintenance interval is achieved on the power electronic switching unit. The electromechanical

circuit breaker has the same maintenance intervals as a standard device. Please consult our product manuals for more detailed information.

5. You mentioned the DC lines needs less Cu. When we turn it around: can we use the current highvolage powerlines (380kV) to transport DC with a higher total power. In other words use the current lines to transport more power

   - In high voltage applications we must take into account the partial discharges that can form in insulation. The AC insulations is likely unsuitable to be reused for HVDC application.

6. do makers max supply I2T capability of semiconductors publicly? as they don't now.

   - The i2t is normally part of the power converter's datasheet so that the customers can choose appropriate fast fuses to protect the converter. However, for SSCB, the i2t is not as important a design parameter since they operate differently and cut off excessive currents before the energy has time to build up.

7. Now we have the Nortsea windparks. I understand most of them will be trans;port energy DC to land - are there initiatives to extend that transport for distribution on land?

   - I believe there are a number of HVDC projects. However, as I work with low-voltage DC applications, I do not have a detailed overview of these infrastructure projects. From a technical perspective, using DC for underwater cable makes sense. However, the more expensive interconnection station to the AC grid means that if the distance to the wind park is too short, the economics of the HVDC link are likely negative.

8. If you in time expand the grid with users with capacitors IN dc and how do you know if the old design I2T still fit. as we have no control over the expansion of the grid?

   - If there is a need for further expansion of the grid, a concept similar to bus-tie breaker that we now from marine industry can be applied. Effectively we interconnect the old and the new DC grid with a SSCB. The SSCB will decouple the fault energies of the two systems.

9. How are we going further?

   - We are already going further. DC vessels continue to grow in popularity, especially as battery energy storage becomes more economical. In fact, as we see more BESS systems deployed, it is likely that these systems will also bring the dawn of DC applications. Since BESS is much more efficient when coupled with a DC bus.

10. Would voltage discrimmination not be a solution for the national grid?

    - I am afraid that I am not the right person to answer the question.

11. Well done presentation, very well done, also the technical side of ultra rapid switching, very good explained.

    - Thank you very much for the kind feedback. It was a pleasure to join you today!

12. PS discrimmination with ultra rapid switching is possible. In stead of current discrimmination.

    - I am afraid that I am not the right person to answer the question.

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15. Thank you, very interesting.

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16. Thank you very much for the kind feedback! I ma looking forward to our future discussions. 🥰

17. De moderator was ing. Coos Koster KIVI Elektrotechniek (Teamlid Lunch webinars)

18. 13:15 u. Meeting ends. Royal Netherlands Society of Engineers (KIVI)
    Electrical Engineering: "DC systems in practice. This is how you do it." by Pavel Purgat
    on Wensday July 09, 2025 time 12:00 u. - 13:00 u.

Version 1.0 July 14, 2025

Chats and Answers E Lunch webinar ""DC systems in practice. This is how you do it." July, 9, 2025