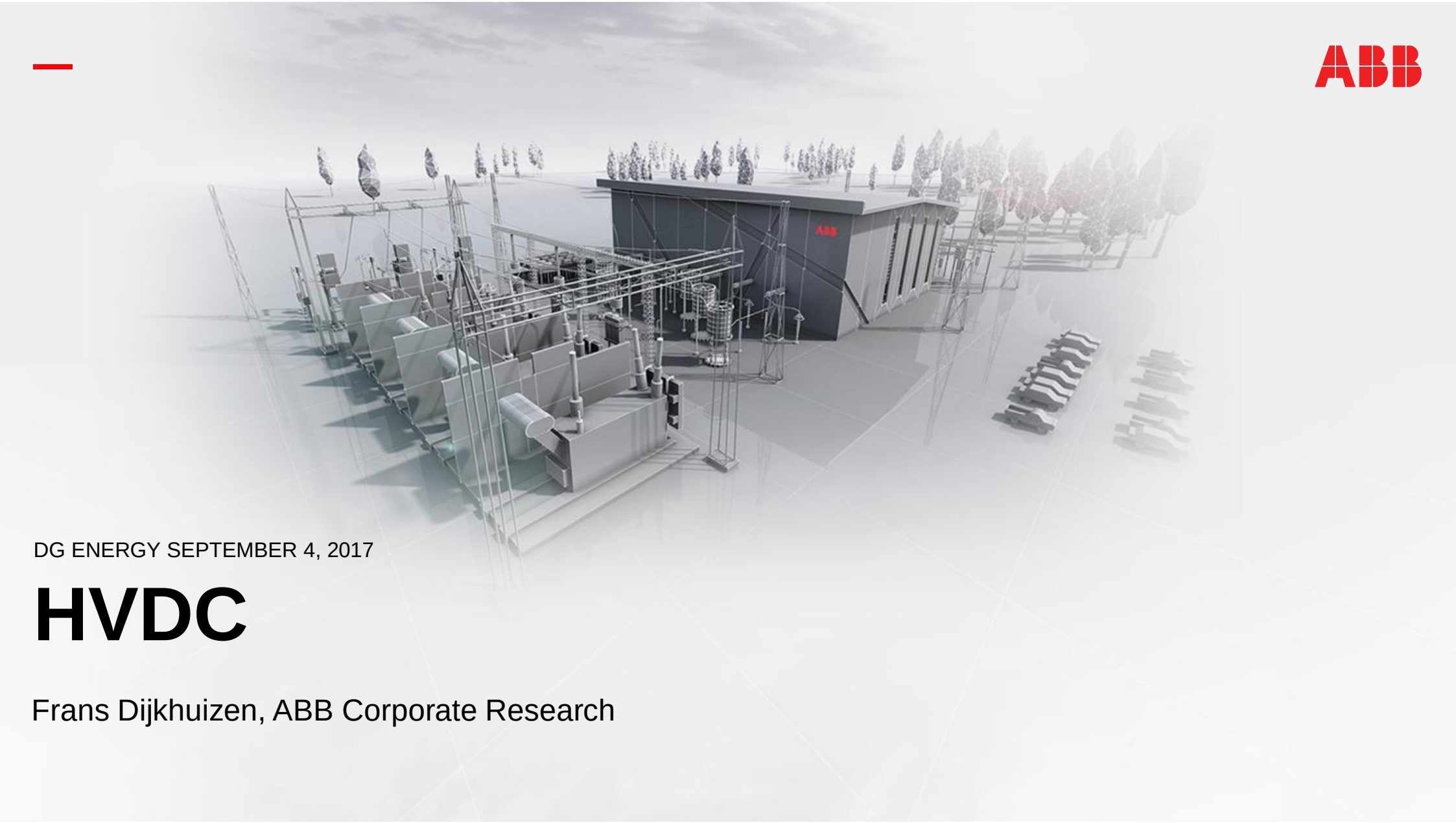
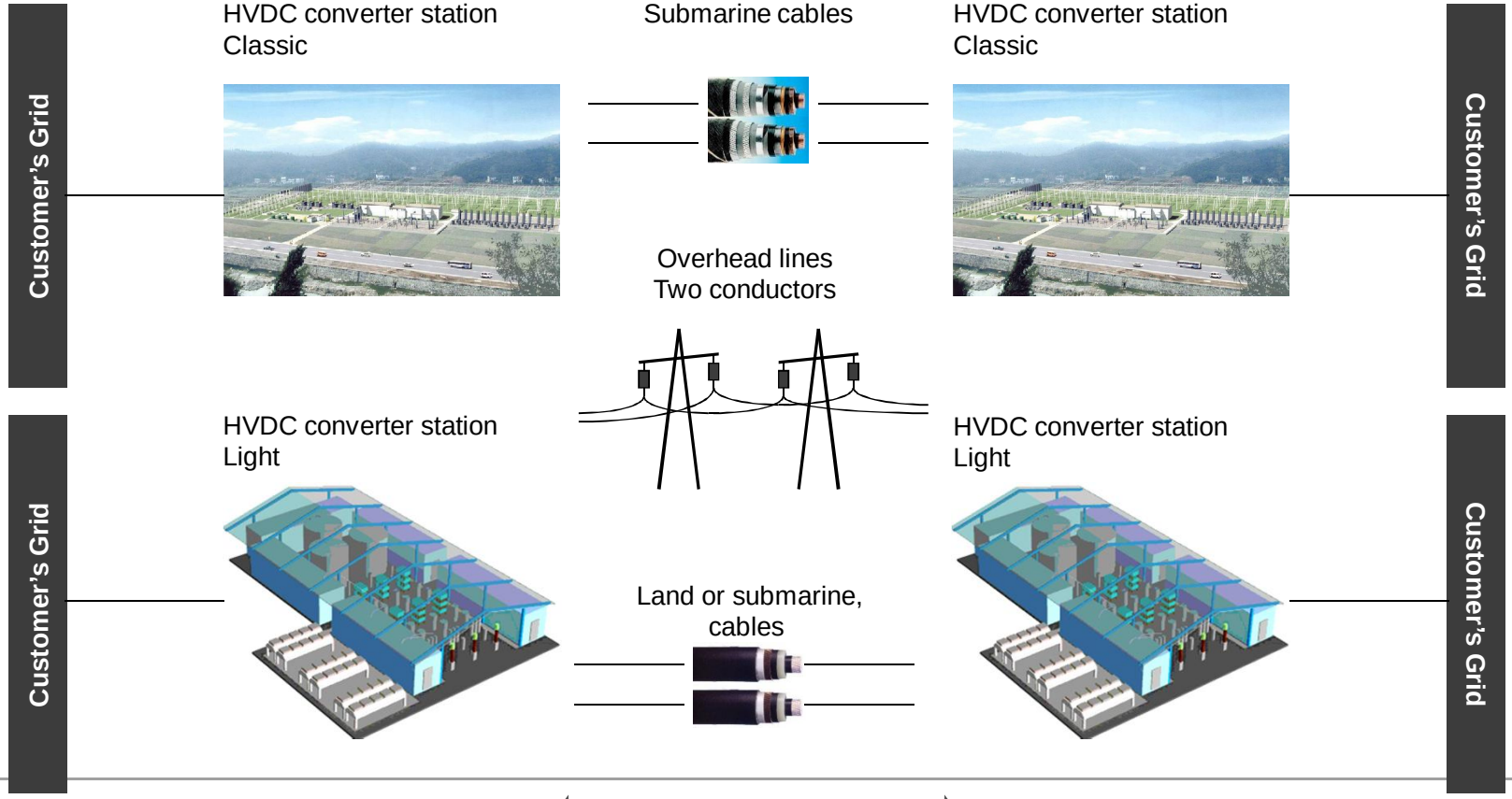


DG ENERGY SEPTEMBER 4, 2017

HVDC

Frans Dijkhuizen, ABB Corporate Research

What is an HVDC transmission system ?



Technology advancements

A. Transistor-based Power Semiconductors (BIGT)

B. Ultrafast, selective and distributed Control & Protection (MACH)

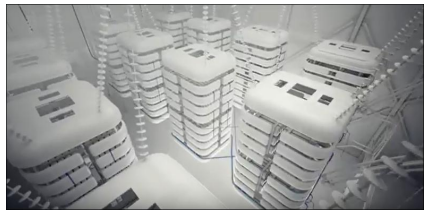
C. Mimicking UHVDC design

D. Hybrid HVDC Breakers (HHB)

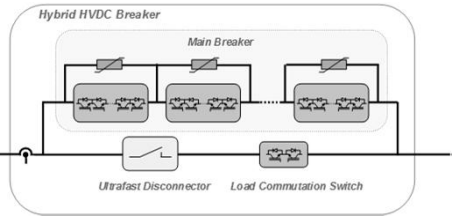
E. Introduction of 640 kV extruded cables (non-ABB)

A

B



C



D

E

https://www.youtube.com/watch?v=r4WRW3XtF4Q&feature=youtu.be

Transistor-based power semiconductors

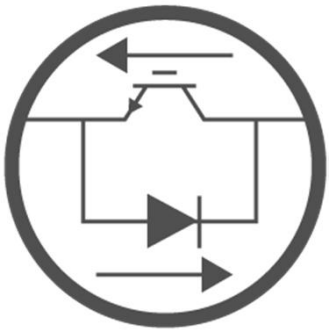
Moving from IGBT and diode configuration to combined diode and IGBT

The BIGT

– Decrease in losses

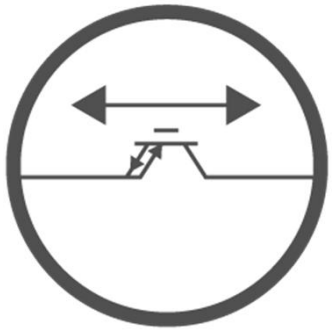
– Major reduction of semiconductor material

– Higher current rating



IGBT – Insulated-gate bipolar transistor

The traditional method requires semiconductor material for both the IGBT and return diode



BIGT – Bi-mode insulated-gate transistor

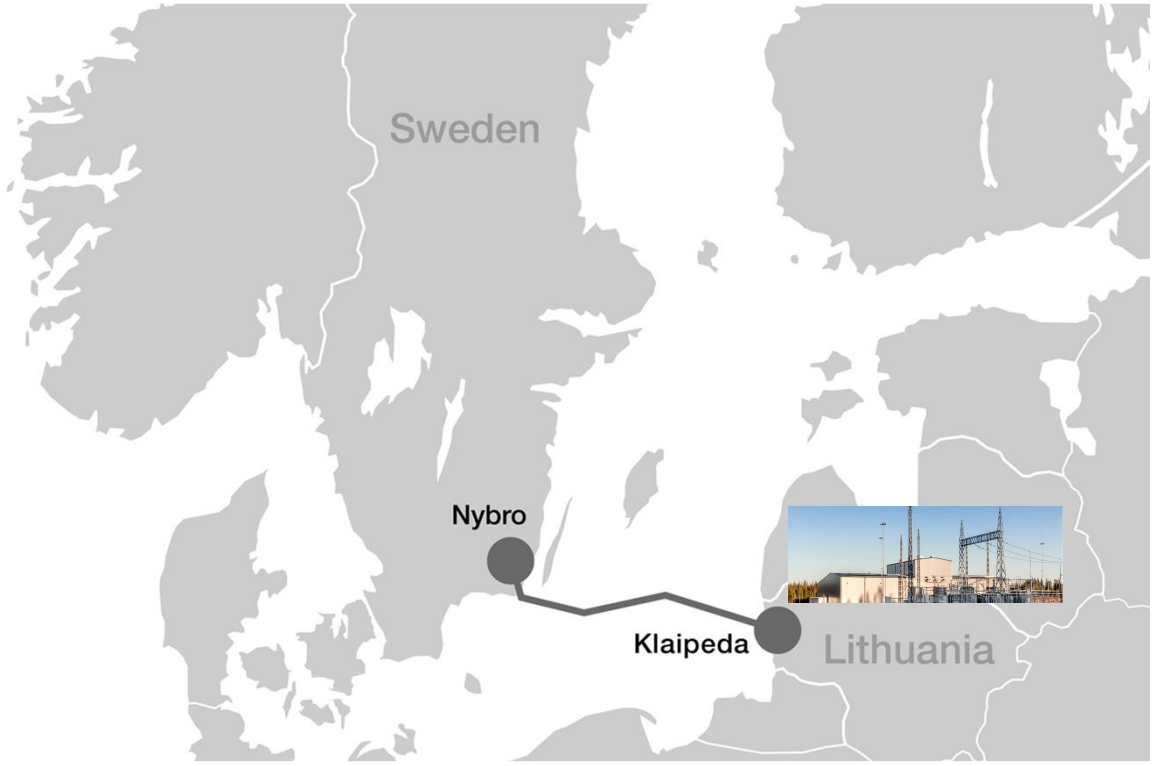
The BIGT eliminates the need for the diode halving the semicondutor material required, decreasing losses

NordBalt

Lithuania – Sweden

Main data

Customer	Svenska Kraftnät and LITGRID turtas
Customer needs	• Strengthen security of supply in Baltic region and southern Sweden • Integrate electricity markets of the Baltic and Nordic countries
ABB's response	• Turnkey 700 MW HVDC Light system • Designed for integration into a future pan-European DC grid
Customer benefits	• Low losses and high reliability • Network stability through active AC voltage support • Quick grid restoration with black-start capability
Year	• 2017



Summary

The grid of the future will request resilient, reliable, flexible, secure, sustainable, and affordable electricity (DOE Grid Modernization Initiative, 2016)

HVDC technologies are smart and sustainable options for transmission grid modernization and optimization of existing grid assets

Operational features of embedded HVDC systems are becoming increasingly important to grid planning and operations