



Finding new data center efficiency through high-voltage direct current power

Lutz Boettger and Mike Miller / October 24, 2012

Agenda

A brief history of direct current technology

Case study “green.ch”

ABB power system overview

Moving Forward

Next development steps in HVDC for data centers

HP HVDC Adoption and product enablement plans

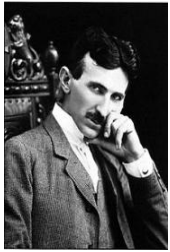
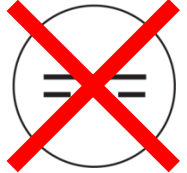
Discussion

A brief history of direct current technology



“War of Currents” era in the late 1880s – AC “won”

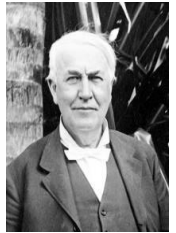
- Global power systems have predominantly relied on AC technology for the past 100+ years
- HVDC has been used for bulk power transmission since the 1950s



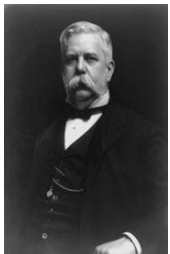
Nicola Tesla

Today, an increasing number of consumers run on DC, e.g.:

- Consumer electronics and industrial IT
- LED lighting
- Fast EHV chargers etc.



Thomas A. Edison

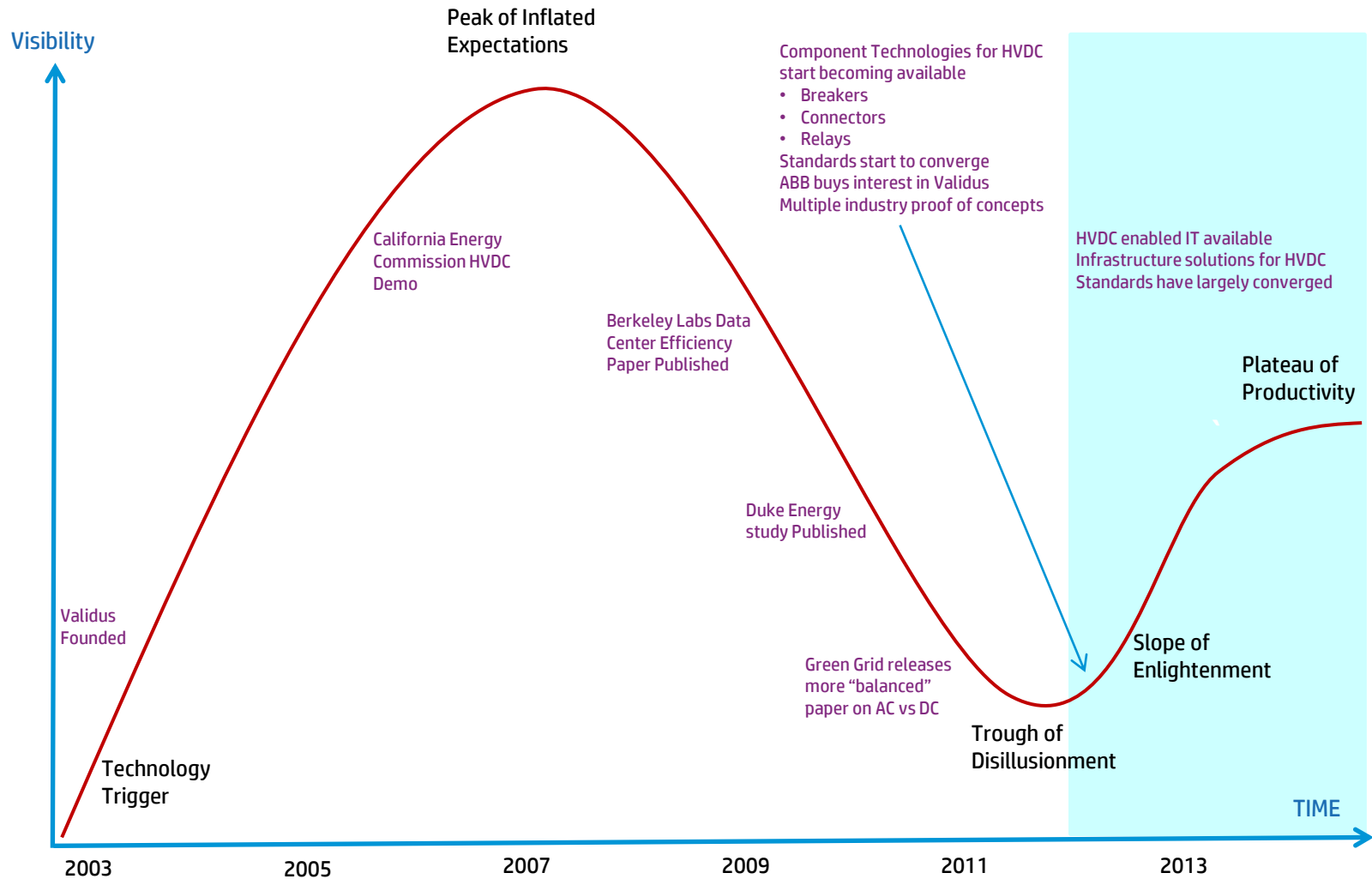


George Westinghouse

Decentralized power plants (PV, wind, fuel cell) generate in DC

- **Requirement for several conversions and transformations leads to losses in the total power system**

HVDC Adoption Cycle



Customer Needs by Region

Wide range of DC power needs across regions

Long term convergence trending towards 380VDC

Early opportunity driven by:

- Telco
- Greenfield
- Modular data centers



Case study “green.ch” - introduction

green.ch was founded in 1995 and today is one of the leading ICT service providers in Switzerland

Internet access, hosting and data center services for over 100,000 business and residential customers

“Zurich-West” in Lupfig is green.ch’s fourth and most modern data center

Excellent connectivity, access and security on a greenfield site

~ 24,000 sq ft IT-floor with AC power supply

~ 12,000 sq ft IT-floor with DC power supply

Major tenants include HP (European cloud services), Axpo, Saxo Bank, and ABB



Case study “green.ch” - results

-10 %

kWh

Energy efficiency

10% better energy efficiency than comparable AC distribution system, measured “from grid to chip” at 40-60% server load.

-15 %

\$

Capital cost reduction

15% lower capital cost than comparable AC distribution system.

-25 %

sqft

Space savings

25% smaller footprint than comparable AC distribution system.

Case study “green.ch” - summary

The world’s largest “HV”DC-powered data center...

- Only data center in Switzerland to be certified as Tier III data center (Uptime Institute)
- Operated in accordance with ISO 27001 with state-of-the-art entry protection with 24/7 access
- High-performance early fire detection system with automatic nitrogen fire extinguishing system

...with “green” design philosophy

- Up to 100% of power demand served from renewable energy sources (on request)
- Waste heat utilization in adjacent corporate office building
- PV installation



Case study “green.ch” - owner’s perspective

“Our goal is to employ the most reliable and cost-effective technology while providing global data center services at the highest standards of output, security and environmental stewardship. [...]

Our company name is a statement for ecology. The new DC technology of ABB allows us to fulfill our environmental responsibilities as part of our long-term goals.

The implementation of 380V DC technology in our data center is part of our long-term energy optimization strategy, a big step that has set a new standard in the industry. When fully loaded, the system will result in energy savings of up to 20% in power consumption from grid to chip and in cooling.”



Franz Grueter, CEO of green.ch

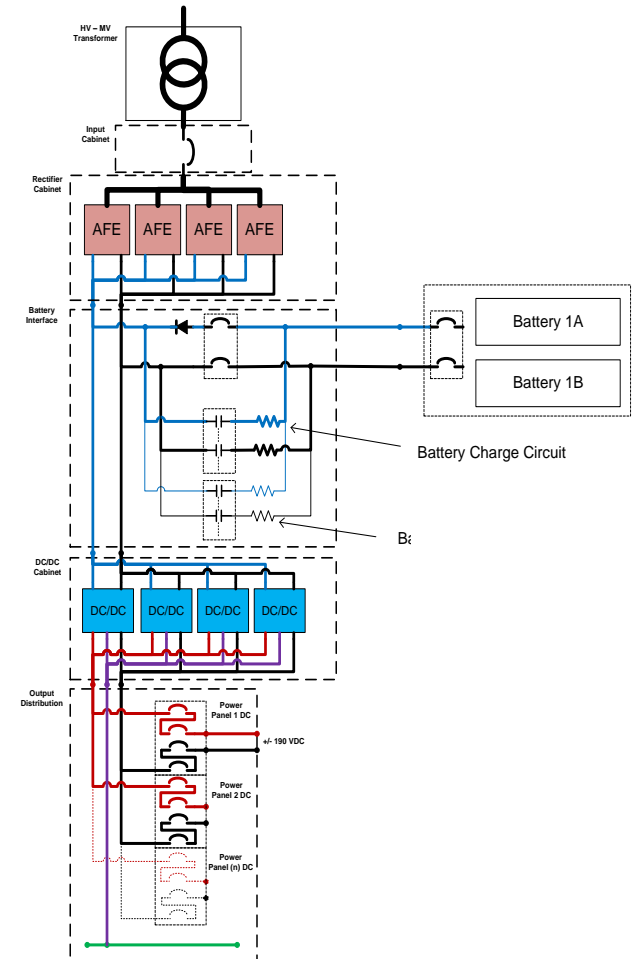
Moving forward - next steps in HVDC development

Establish technical standards (IEC, ANSI, etc.) for “HV”DC power distribution

Build a “HV”DC-enabled eco-system with industry leaders

Completion of improved ABB Gen II design

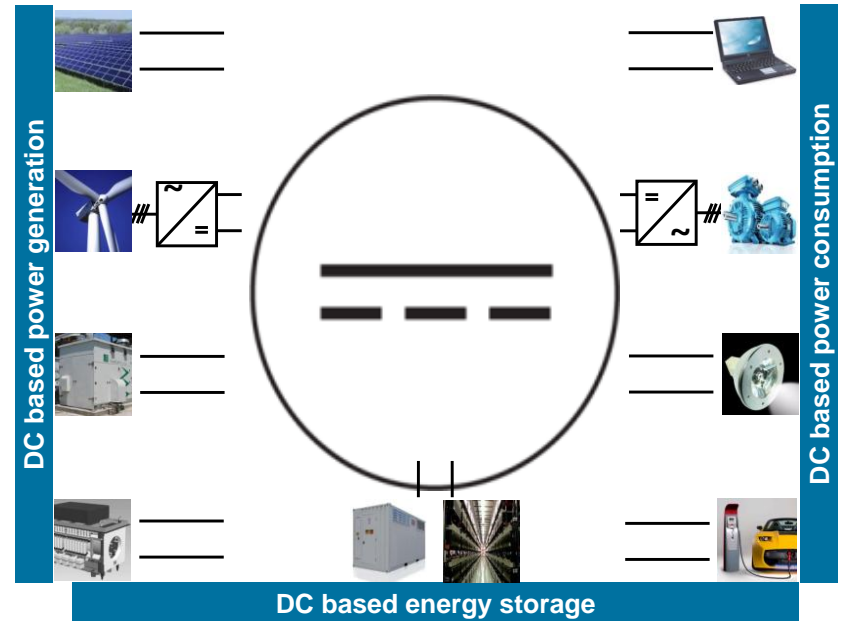
- Modular design with “hot-swap” capability
- Scalable in 250 kW increments up to 3.75 MW per system
- Flexibility of AC input voltage
- Independent management of multiple battery strings
- Stable output voltage for use of narrow-band PSU’s with 3-5 %-points improved energy efficiency
- Low short circuit current
- Type-tested for arc-resistance



Moving forward - next steps in HVDC development

“Grid-to-chip“ DC micro-grid that ties together a variety of power sources, energy storage and consumers

- No inefficient conversion
- No complex synchronization
- No harmonic distortion and reactive power flow
- Increased reliability
- Increased efficiency



HP - HVDC Support Plans

Power Supplies

Common Slot,
1200W, HVDC



This PS is designed to support:

- DL/ML/SL with exception of entry SMB
- C3000
- Several storage platforms (~20 models)
- Some Networking products

Blade FF, 2400W,
HVDC

This PS is designed to support:

- C7000 Blade System Enclosure
- Superdome platforms

1st half 2013

2nd half 2013

Infrastructure

HVDC PDU

Thank you.