Caprivi Link Interconnector
A step further in HVDC Light technology

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Caprivi Link
HVDC power transmission thru the Caprivi strip

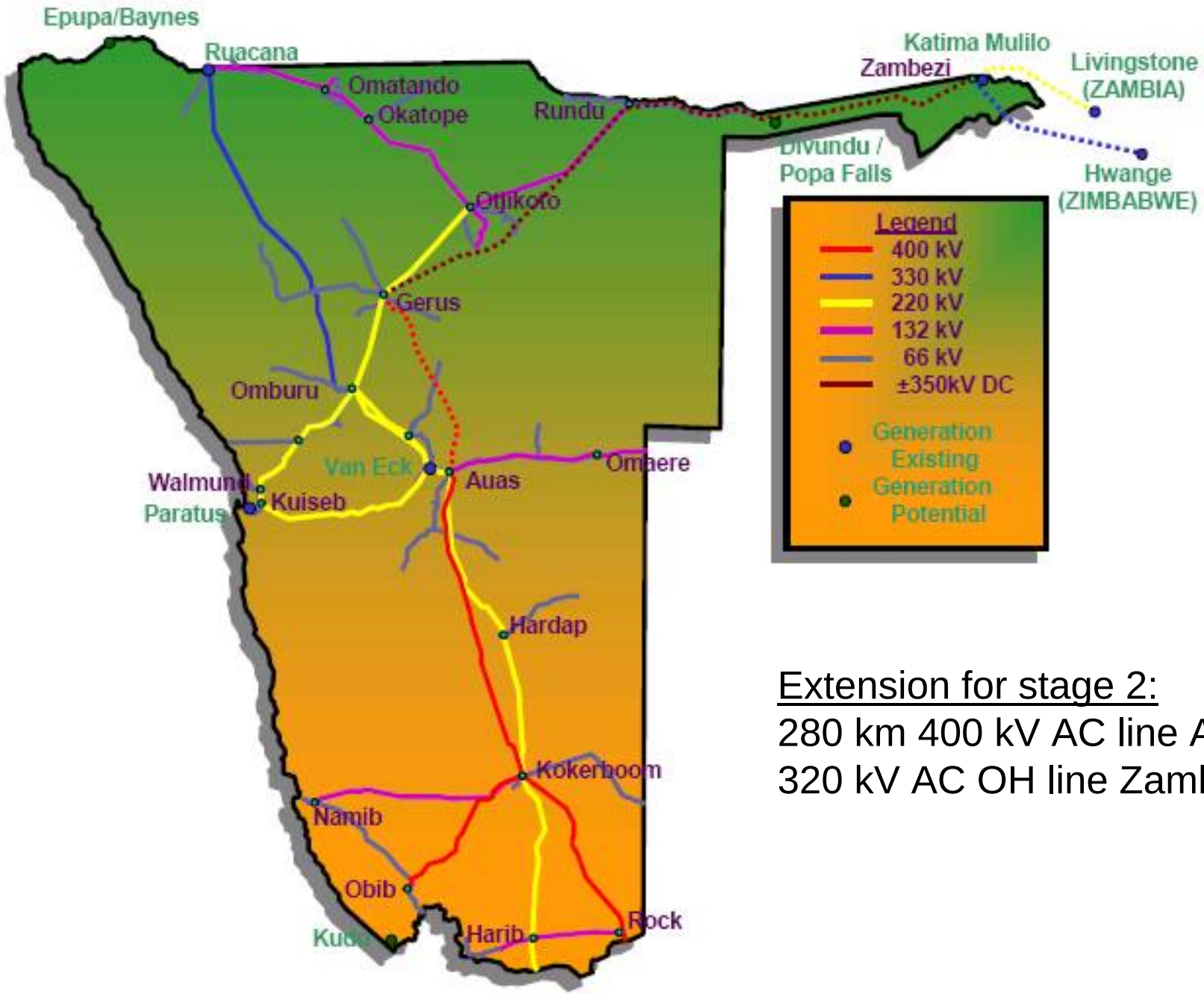
Secure power supply to Namibia
- **Hydro power from Zambia**
- **Coal fired power from Zimbabwe**

<u>Stage 1:</u>
- **300 MW monopole**
- **converter and electrode stations at Zambezi and Gerus**

- **970 km ±350 kV DC OH-line**
- **~ 50 km electrode lines**

<u>Stage 2:</u>
- **Extension to 2 x 300 MW bipole**

Caprivi Link: The DC link in Namibia's power grid



Extension for stage 2:

280 km 400 kV AC line Auas-Gerus

320 kV AC OH line Zambezi – Hwange

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Project history

- 2002: Small scale HVDC Light cable link
- 2004: Need of larger scale transmission
- Aug 2006: RFQ – conventional HVDC scheme
- May 2007: ABB offered:
  - Conventional HVDC scheme with 6 SCO at Gerus and SVC at Zambezi + 1 SCO for black start
  - Conventional HVDC scheme with 6 SCO at Gerus and 5 SCO at Zambezi
  - HVDC Light scheme for OH-lines

  ABB awarded order on conventional HVDC, but client preferred HVDC Light scheme
- Jun-Sept 2007: ABB and client agreed on 4 months verification period of new technical solutions for VSC alternative
- Nov 2007: Project start

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ABB's scope of work

- Gerus and Zambezi converter stations including AC double bus connection to substations
- Converter buildings and service building
- Electrode stations
- PLC back-up communication
- Engineering, manufacturing, procurement, transportation, civil work, installation, supervision, commissioning, training and 2 years O/M support

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Delivery time

- Monopole: 26 months – in service Jan 16, 2010

- Bipole: option valid 18 months – 24 months delivery time starting Jan 16, 2010

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The customer's choice

- Why transmission?
  Generation alternatives more costly and uncertain
- Why HVDC?
  AC alternative unrealistic
- Why 350 kV DC-line?
  Lowest cost
- Why HVDC Light?
  Lowest investment cost and evaluated cost including losses
- Why bipole?
  N-1 criteria << 600 MW and stage-wise construction

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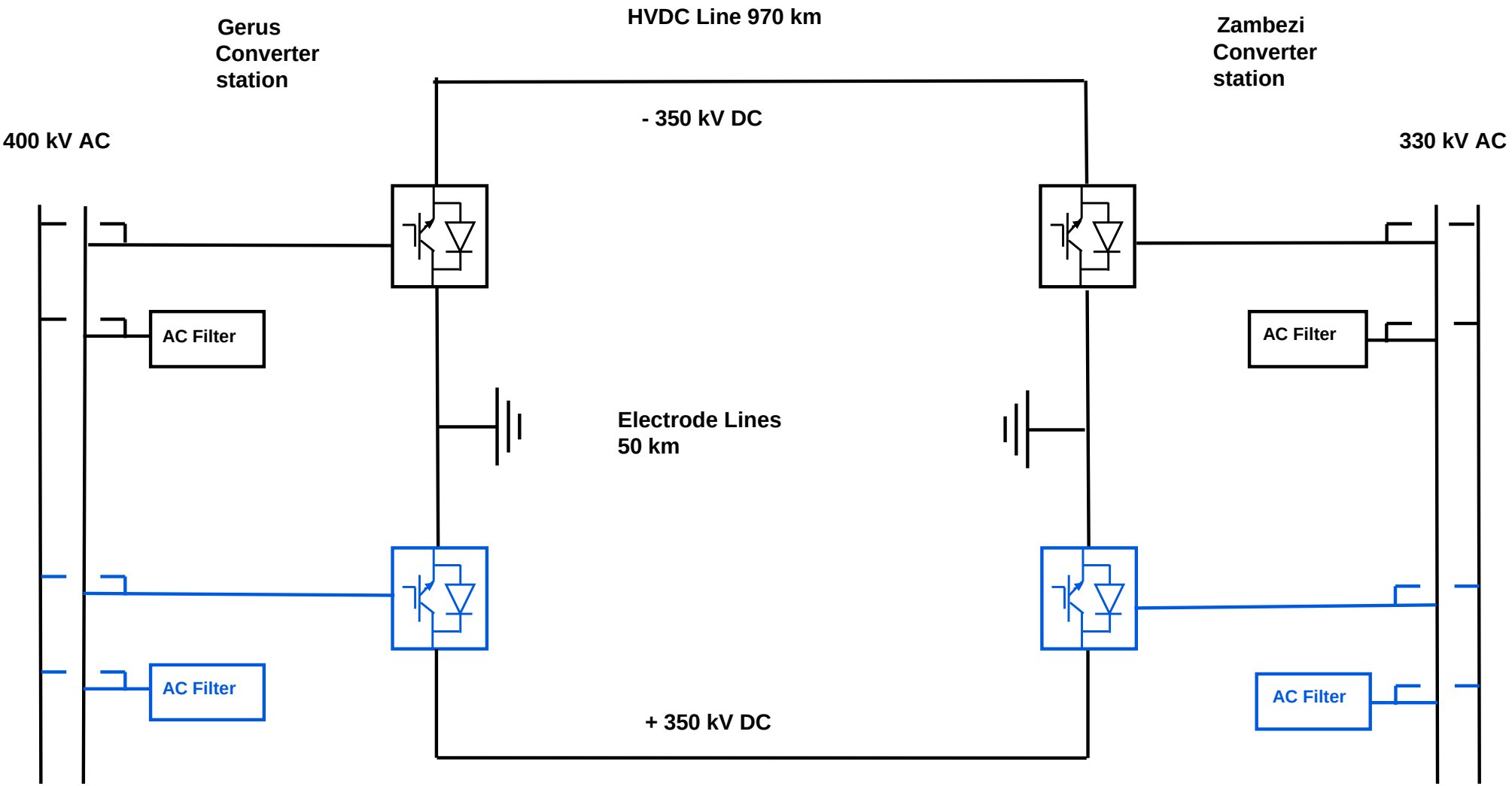
HVDC Light link in two stages



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Features

- + 300/600 MW import to – 280/560 MW export without switching of AC filters (2*350 MW overload capability)
- ± 200 MVar at continuous AC voltage control of 400 kV/320 kV grid at Gerus/Zambezi
- Changes switching pattern between steady-state and during disturbances
- Stable and robust power transfer from 300 MVA minimum short circuit power to maximum 1400 MVA
- Black start of Caprivi region at power outages
- Frequency control at islanded AC grids
- Re-start after DC-line faults at lightenings within 500 ms after clearing

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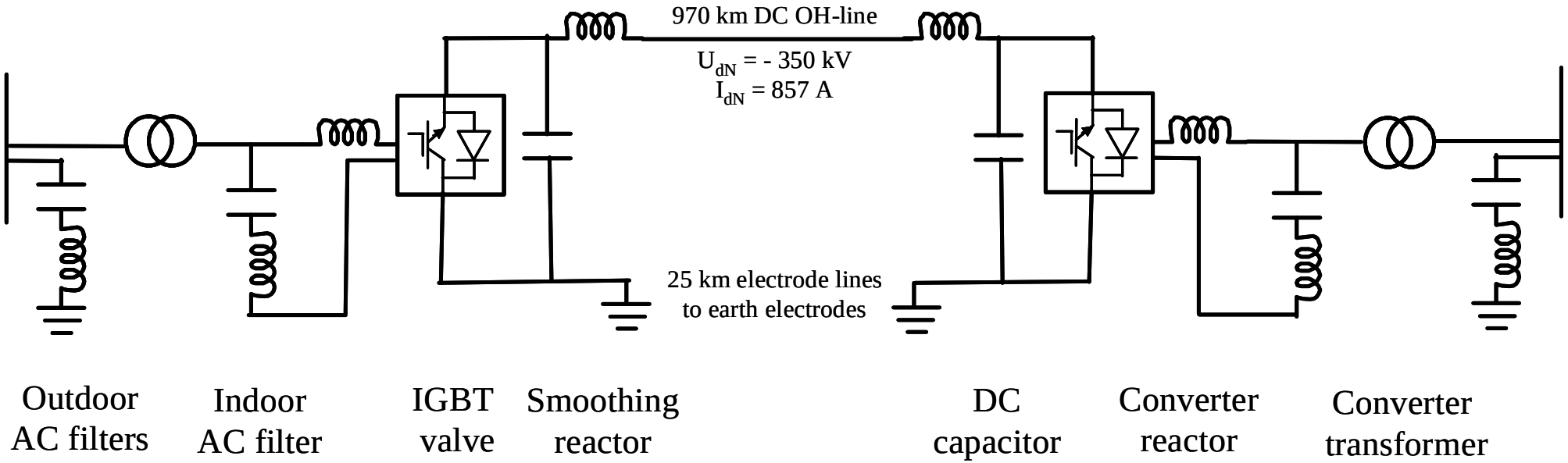
Circuit solution



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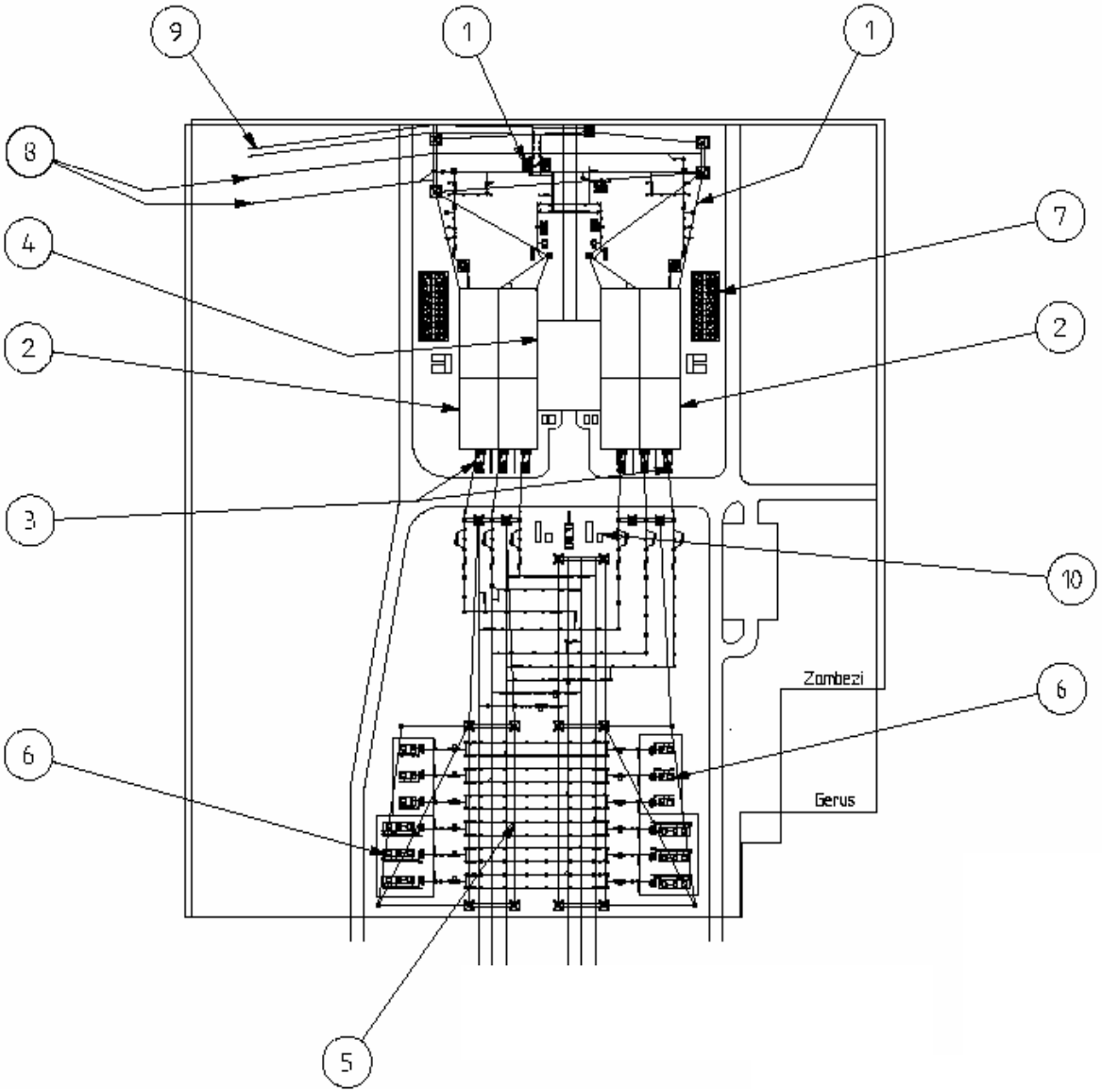
Bird’s eye view of converter station



1. DC yard
2. Converter building
3. Converter transformer
4. Service building
5. AC yard
6. AC filter
7. Coolers
8. DC line
9. Electrode line
10. Diesel generator

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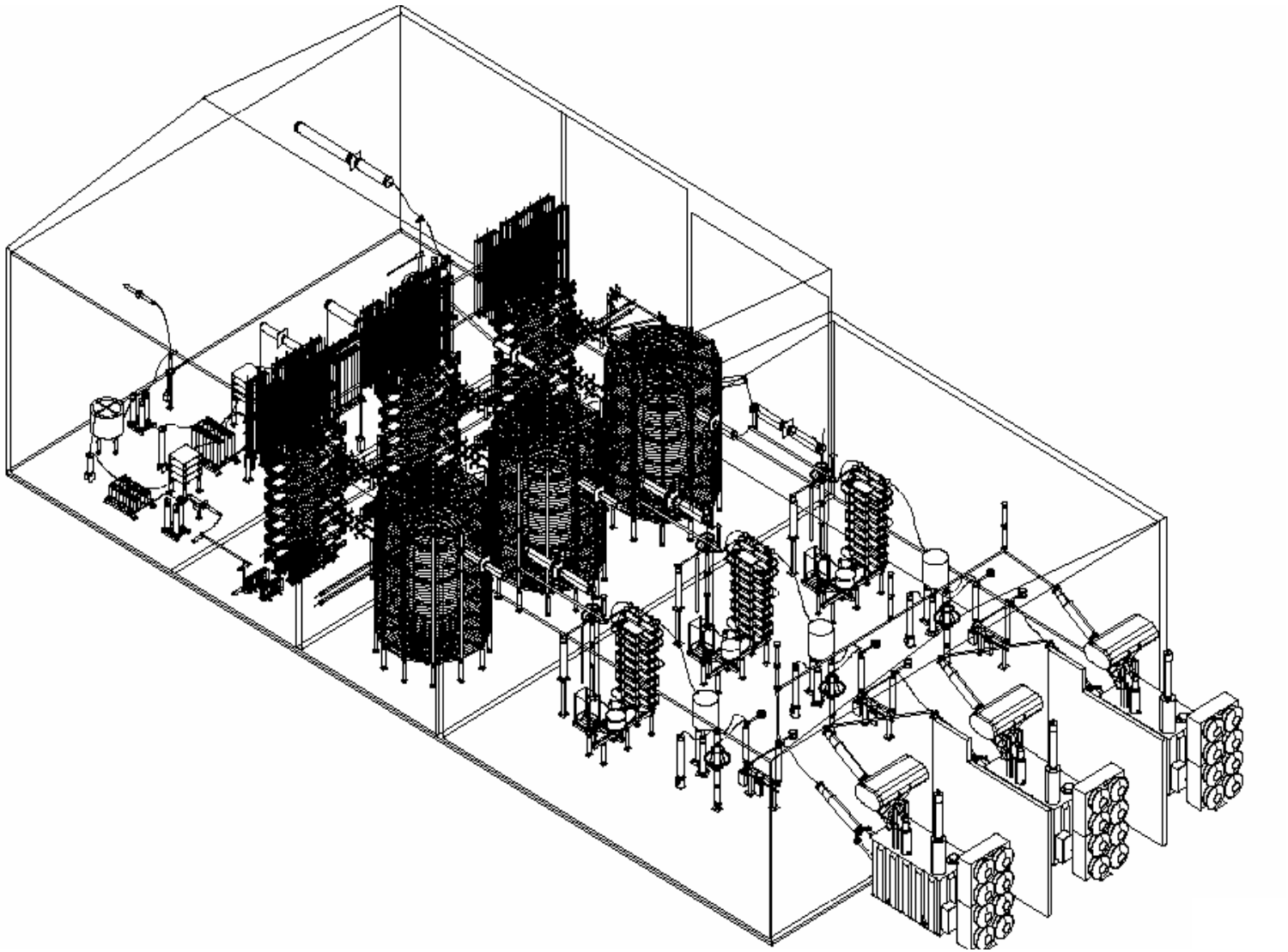
Converter building



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Milestones – First HVDC Light project…

- … with OH-line for commercial use
- … operating at 350 kV DC
- … configured as a bipole
- … linking two extremely weak AC grids
- … to be a corner stone in the power supply of a country
- … in Africa

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