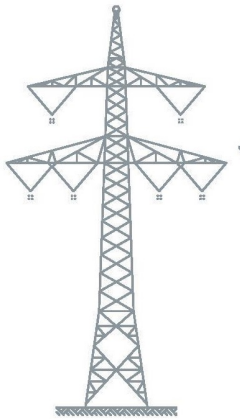
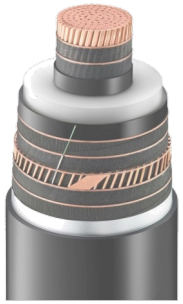
Cable & Civil

Dierk Schönwald

SuedLink – the underground development





2013 — **Start of engineering as overhead line**

2015 — Bundestag & Bundesrat decide DC projects to be underground preferred

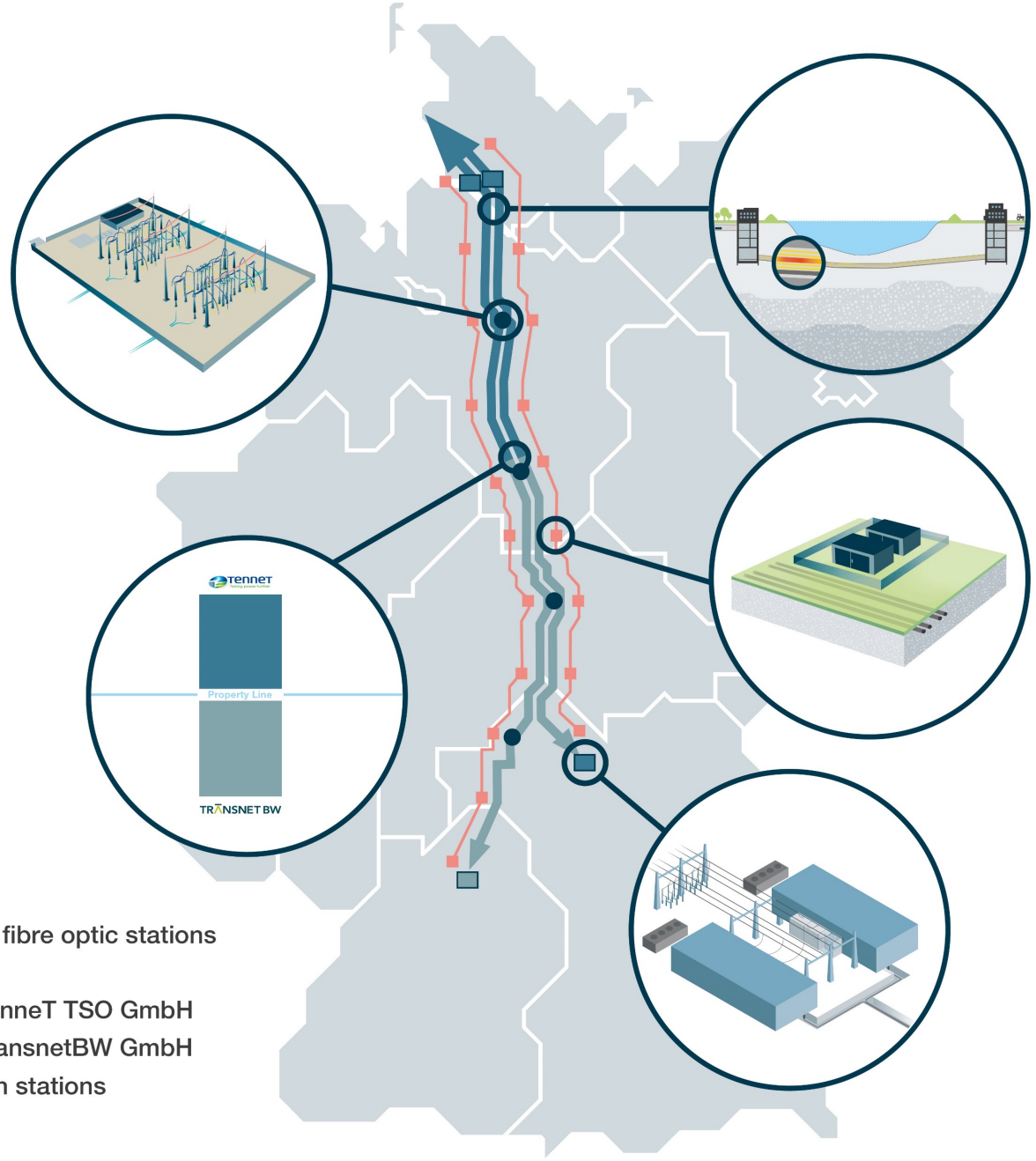
2016 — New method paper from BNetzA with renewed reqirements

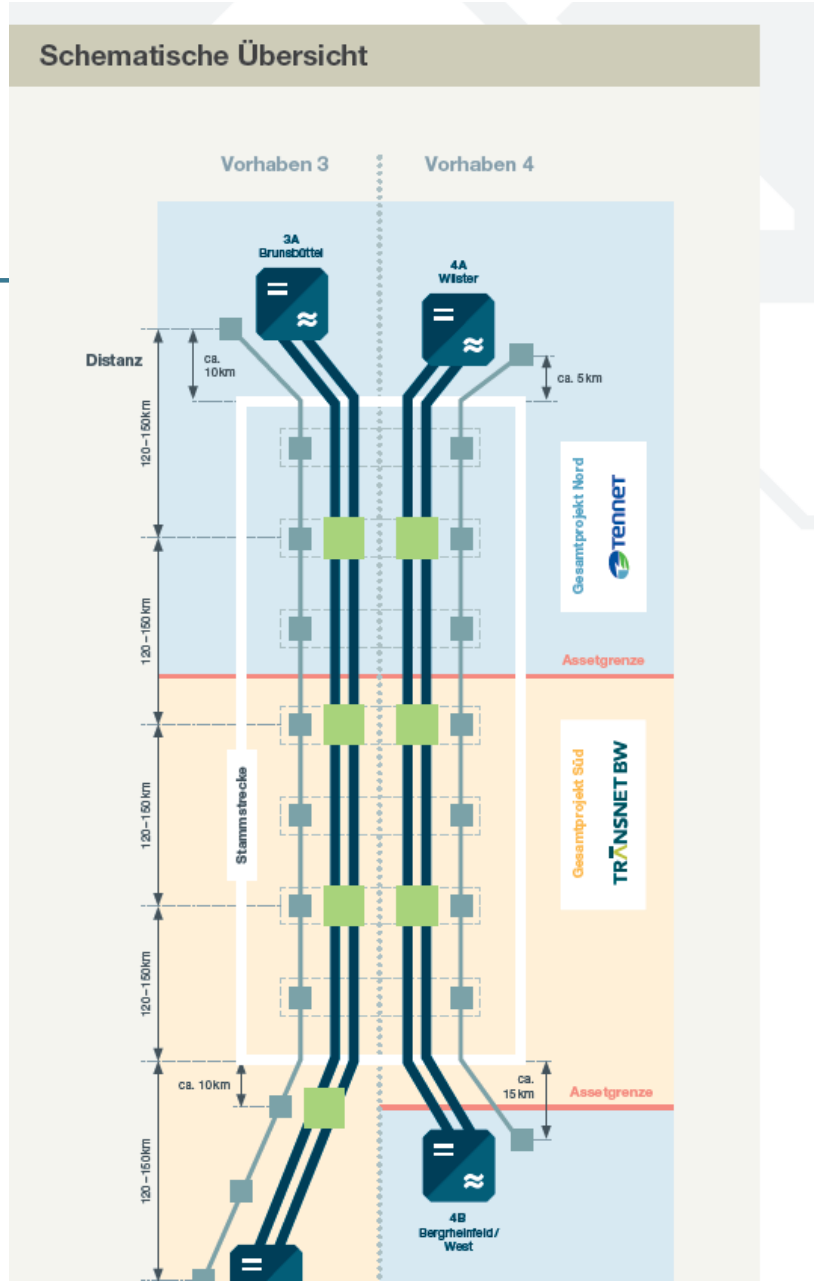
late 2016 — Environmental planners develop first corridors

On-going — Engineering cable routes underground only

§ **New law**

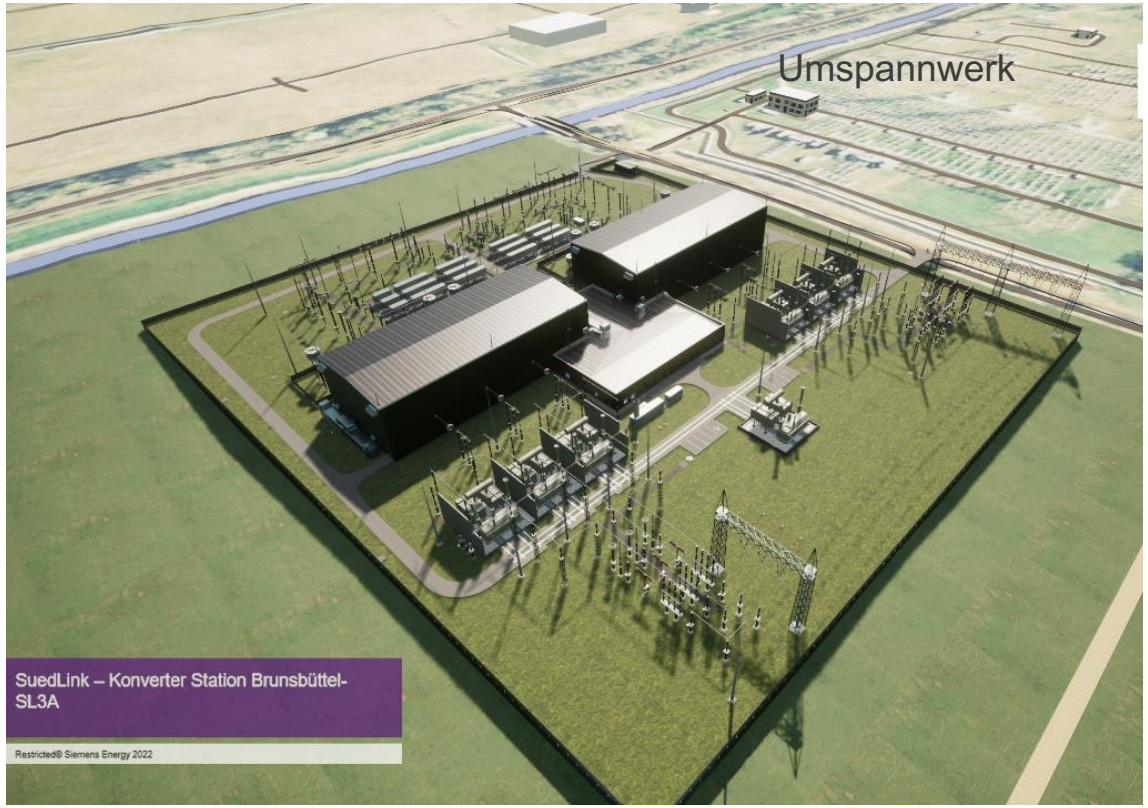
December 2015: „*Gesetz zur Änderung von Bestimmungen des Rechts des Energieleitungsbaus*“ preferred solution of DC projects is 100% underground.


TENNET
Property Line
TRANSNET BW
Intermediate fibre optic stations
Optical fibre
Converter TenneT TSO GmbH
Converter TransnetBW GmbH
Cable section stations


Schematische Übersicht
Vorhaben 3
Vorhaben 4
3A Brunsbüttel
4A Wilster
4B Bergrheinfeld/ West
Distanz
ca. 10km
ca. 5 km
120–150km
Gesamtprojekt Nord
TenneT
Assetgrenze
Stammstrecke
Gesamtprojekt Süd
TRANSNET BW
ca. 15 km

Converter Station Vorhaben DC3

Picture shows station Brunsbüttel



Power Output: 2GW
Voltage: DC ±525kV
Current: DC 2100A

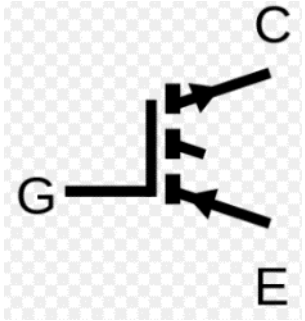
Abilities:

- Energy transmission in both directions
- Reactive power for grid stability (required because of switch off of conventional generators)
- Grid oscillation damping capability
- Voltage and frequency control
- Grid Forming: provision of synthetic short circuit power
  Due to shut off of rotating generators
- Black start capability: supports grid restoration after blackout
- Unmanned operation (remote control from dispatch centers)
- Easy power flow control in comparison to AC grids
- Low loss solution for long distance energy transmission
- High availibilty, low maintenance

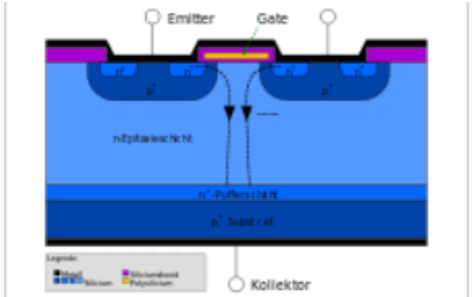
IGBT – remote controlled breaker

a IGBT (insulated-gate bipolar transistor) is a bipolar transistor with insulated gate electrode

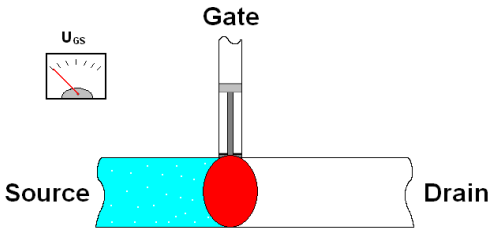
„remote control



Circuit symbol



Schematic structure of a PT-n-channel IGBT

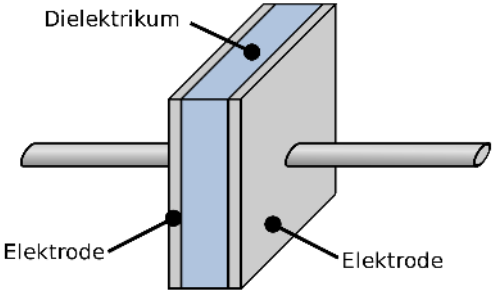


Work principle

construction of a power-IGBT

Capacitor

symbol



schematic construction

2 projects – 2 suppliers

NKT – Lot 3-1 and Lot 3-2

HQ Denmark

Production

- Germany, Cologne (DC Cables)
- Sweden, Karlskrona (DC Cables)
- Sweden, Alingsas & Sunne (Accessories)
- Finland, Pikkala (DC Cables)

Prysmian – Lot 4-1 and Lot 4-2

HQ Italy

Production

- France, Gron and Montereau (DC Cables
- Italy, Livorno (Accessories)
- Romania, Slatina (Accessories)
- UK, Bishopstoke (Accesories)
- Germany, Nordenham (Accessories)

Underground cable: structure

XLPE

- Isolierung bis **600 kV DC** für unterirdische und unterseeische Anwendungen
- Niedrigere Systemkosten und leichtere Kabel für Spannungsebenen bis **320 kV**
- Neues Material mit geringer elektrischer Leitfähigkeit
- Hohe Materialreinheit
- Gleiche thermische Leistung wie das bisher für bis zu **320 kV** verwendete DC XLPE
- Gleiche technologische Plattform für XLPE-AC- und DC-Kabel

Bending radius:

During laying procedure:
30 x 151,5 mm outer diameter (upon cable reels)
35 x 151,5 mm outer diameter (in cable trench)
After laying: 20 x 151,5 mm outer diameter

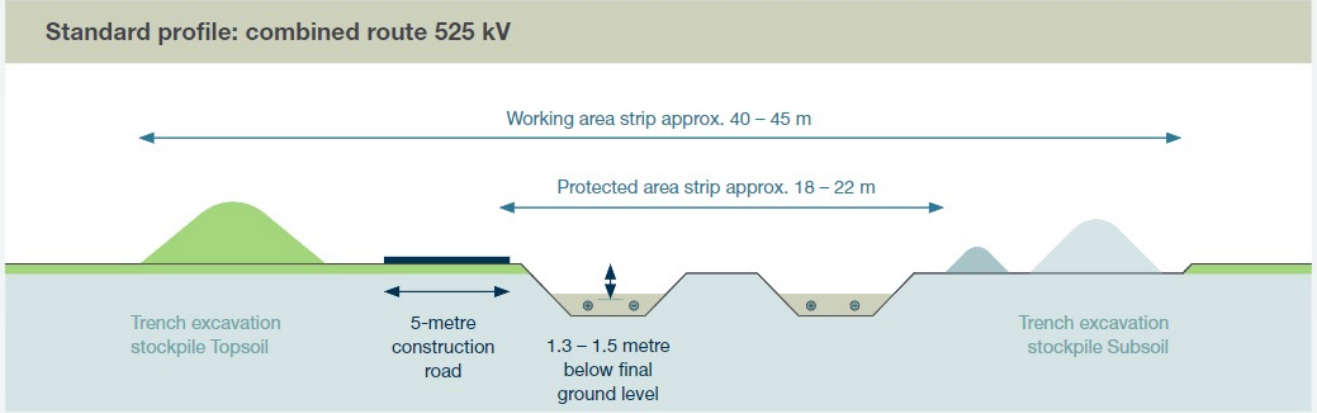
Joints & link boxes

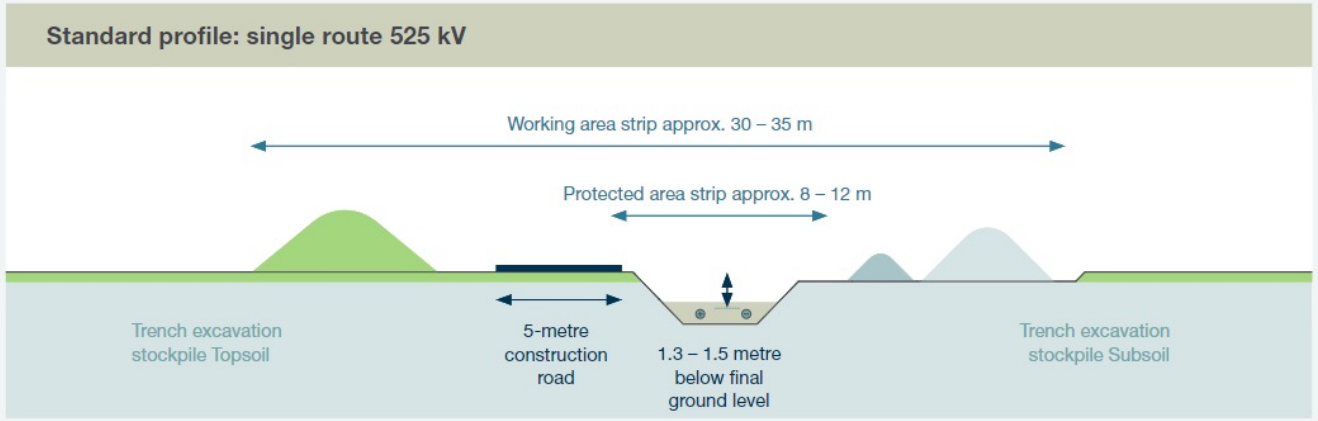
1. Overlapping cable laying into the trench (see also ilustration 5)
2. Set up of special container for joint installation
3. Installed joint before backfilling the joint

Link boxes

- Assist to locate defect cables (reduces potential downtimes)
- Grounding cable screens in link box
- Positioning on streets and paths alongside the cable route
- Completely underground possible depending on location
- Appr. Every 10 km; only a few square meters big

SuedLink profile





Standard profile: combined route and single route

Open trench cable laying – construction process

Removing top soil

>> taking off mother soil
>> temporary storage
>> if neccessary greening, protection against dehydration and drift of soil

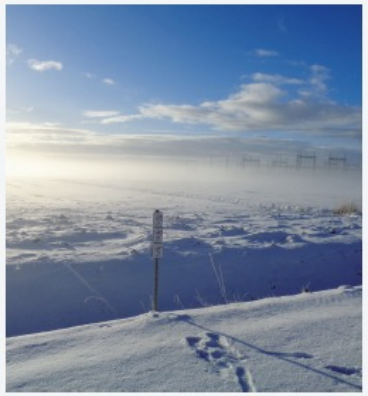
Building trench-profile

>> removing sub-soil
>> where required separate storage of soil layers
>> installation of temporary water drainage
>> installation cable bedding

Pulling cable

>> transportation of cable reels
>> pulling cable into the trench

Open trench cable laying – construction process



Joints

>> installation of joint containers
>> mounting the joints
>> uninstalling joint containers
>> pouring on bedding material onto the joints

Backfilling trench

>> pouring on bedding material onto the cables
>> installation of protective plates
>> backfilling subsoil
>> installation of warning tapes on the cable route
>> backfilling of remaining sub- and topsoil
>> controlling backfilling soil (proof of compaction)

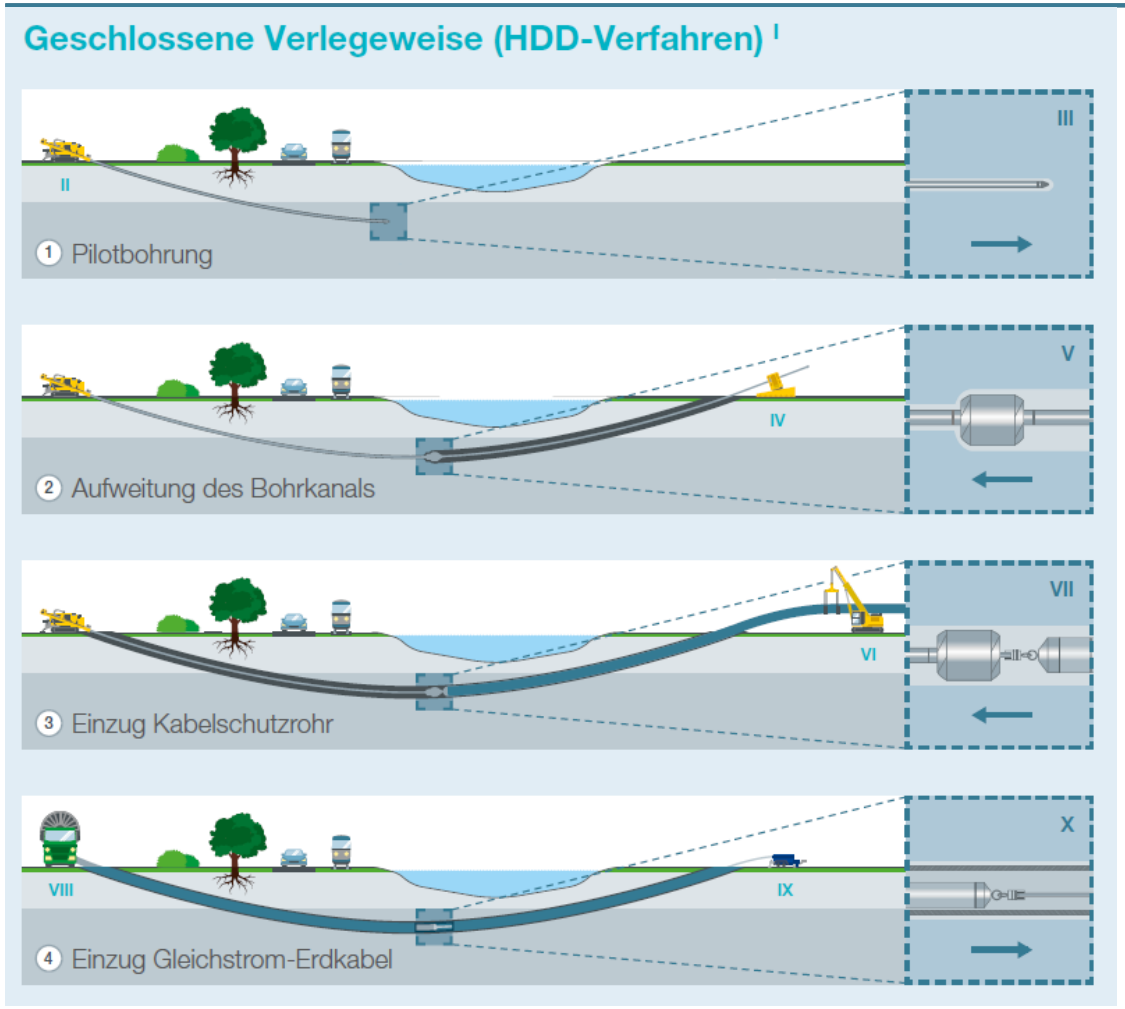
Recultivation

>> restoring surface area
>> fertilization if necessary
>> fresh sowing if necessary

Use of land after construction

>> agriculture and livestock farming possible
>> no builing development and deep-rooted woody plants

Trenchless construction - HDD



Pilot drilling

Reaming

Conduit pull-in

Cable pull-in

TenneT TSO GmbH
Bernecker Straße 70
95448 Bayreuth

+49 (0)921 50 74 00
info@tennet.eu
www.tennet.eu
+49 (0)921 507 40 50 00
suedlink@tennet.eu
suedlink.tennet.eu

TenneT ist bei SuedLink für den nördlichen Trassenabschnitt und die Konverter in Schleswig-Holstein und Bayern zuständig.