TECHNOLOGY FACTSHEET

ELECTRICITY NETWORK LOW-VOLTAGE

Date of factsheet	21-1-2021
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Sector	Infrastructure
ETS / Non-ETS	Non-ETS
Type of Technology	Network
Description	A low-voltage network (LV) is part of the distribution system that carries electric energy to end-consumers. The LV networks start from the output side of the MV-LV transformers. The transformers directly feed the different loads, thus constituting the last step in distributing electricity. The voltages used are 220/127 V and 380/220 V, which is regularly equal to the voltage of electric appliances. The topology of these networks depends on the operation voltage, amount of required phases (3 or 1) and the required reliability. The electrical cables can be overhead lines, underground or a mix of both.
TRL level 2020	TRL 9 Commercial technology

TECHNICAL DIMENSIONS

	Functional Unit		Value and Range								
Capacity	km		-								
			Min		-			*Max*			
Potential			Current			2030			2050		
			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Market share		%	-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Capacity utlization factor	1.00										
Full-load running hours per year											
Unit of Activity											
Technical lifetime (years)	40.00										
Progress ratio											
Hourly profile	No										
Explanation	Non-OECD countries are expected to account for the majority of investments in transmission and distribution networks. Investments are required for grid expansion and to enable consumers to access electricity. In total, the length of the global transmission and distribution network is expected to increase from 25 Mkm in 2012 to 93 Mkm in 2035 [6]. Depending on the region, the cost for transmission infrastructure varies between 4%-15% of the total investments and between 27%-34% for the distribution infrastructure.										

COSTS

Year of Euro	2015									
	Euro per Functional Unit	Current			2030			2050		
Investment costs	mln. € / km	0.05			0.05			0.05		
		0.05	–	0.07	0.05	–	0.07	0.05	–	0.07
Other costs per year	mln. € / km	-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Fixed operational costs per year (excl. fuel costs)	mln. € / km	-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Variable costs per year	mln. € /	-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Costs explanation	Costs are based on cable design to operate at 750V. The cost only takes into account the cost of the cables. Cable laying and installation are not accounted for, since it is highly dependant on the network characteristics, i.e. rural or densely populated areas - LV cables designed to operate at 750V current carrying capability range from 30 to 800A. This current varies according to the conductor's condition, its cross-section, insulation material and the number of grouped conductors.									

ENERGY IN- AND OUTPUTS

	Energy carrier	Unit	Current			2030			2050		
Energy carriers (per unit of main output)	*Main output:* Electricity	PJ	-0.98			-0.98			-0.98		
			-0.98	–	-0.98	-0.98	–	-0.98	-0.98	–	-0.98
	Electricity	PJ	1.00			1.00			1.00		
			1.00	–	1.00	1.00	–	1.00	1.00	–	1.00
	Propane	PJ	-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
		PJ	-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Energy in- and Outputs explanation	Distribution systems account for the majority of the total transmission and distribution losses. Failure problems in distribution networks occur more often than transmission. The energy loss is similar in developed countries, i.e. around 5%, with similar infrastructure and population density [4]. For the Netherlands distribution losses are around 4% [4], of which part is due to cable losses and transformer losses. LV networks also account for part of these losses at around 1,9% [4].										

MATERIAL FLOWS (OPTIONAL)

	Material	Unit	Current			2030			2050		
Material flows			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Material flows explanation											

EMISSIONS (Non-fuel/energy-related emissions or emissions reductions (e.g. CCS)

	Substance	Unit	Current			2030			2050		
Emissions			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
			-			-			-		
			Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Emissions explanation											

OTHER

Parameter	Unit	Current			2030			2050		
		-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
		-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
		-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
		-			-			-		
		Min	–	*Max*	*Min*	–	*Max*	*Min*	–	*Max*
Explanation										

REFERENCES AND SOURCES

1 CE DELFT (2017). Net voor de Toekomst.

2 M. Nijhuis, M. Gibescu, J.F.G. Cobben (2017). Valuation of measurement data for low voltage network expansion planning, Electric Power Systems Research.

3 PBL's ENSYSI Model Database.

4 G. Celli et al (2017). Containment of power losses in LV networks with high penetration of distributed generation.

5 CEER (2017). CEER Report on Power Losses.

6 IEA (2014). ETSAP. Electricity Transmission and Distribution.