Project Sheet

Swiss Roof I

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Key Information

Internal Project
AC transmission line
Mostly New

In Permitting

Description

This project increases the capacity between CH and its neighbours DE, AT and IT. This enables to connect large renewable generation in Northern Europe to pump storage devices in the Alps, thus noticeably increasing the mutual balancing between both regions.

Project promoters

SWISSGRID

Countries

Switzerland

National development plan(s)

https://www.swissgrid.ch/dam/swissgrid/projects/strategic-grid/sg2025-technical-report-de.pdf , Switzerland, 2015, page 155

Additional information on the project

https://www.swissgrid.ch/en/home/projects/strategic-grid.html

Beznau - Mettlen

https://www.swissgrid.ch/content/swissgrid/en/home/projects/project-overview/beznau-birr.html

https://www.swissgrid.ch/content/swissgrid/en/home/projects/project-overview/niederwil-obfelden.html

Pradella - La Punt

https://www.swissgrid.ch/content/swissgrid/en/home/projects/project-overview/pradella-lapunt.html

Bassecourt - Mühleberg

https://www.swissgrid.ch/content/swissgrid/en/home/projects/project-overview/bassecourt-

muehleberg.html

Mettlen - Ulrichen

https://www.swissgrid.ch/content/swissgrid/en/home/projects/project-overview/mettlen-ulrichen.html

Project sheet backlog

6 Nov. 2020 - Publication as part of the draft TYNDP 2020 package for consultation

ENTSO-E

Project Description & Context

Project Investments

Main investment(s): Reinforcement of the existing 220 kV line to 380 kV

Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
AC transmission line	87.1	Mettlen	Ulrichen	In Permitting	2035	Delayed	preliminary clarifications

Other investments

Description	Type of element	Total route length (km)	From substation 1	To substation 2	Present status	Commissioning year	Progress of the investment	Explanation in case of delay or reclustering
Optimization of the existing route by voltage conversion to 380 kV, partial reinforcement.	AC transmission line	64	Beznau	Mettlen	In Permitting	2029	Delayed	Permitting procedure
Reinforcement of the existing route	AC transmission line	49	Pradella	La Punt	Under Construction	2022	Delayed	sundry reasons
Reinforcement of the existing route by voltage conversion to 380 kV including a new 380/220 kV transformer in Mühleberg.	AC transmission line	45.4	Bassecourt	Mühleberg	In Permitting	2027	Delayed	Permitting Procedure

Reason for investment clustering

The investments of the Swiss Stategic Grid 2025 that chiefly contribute to increasing the cross-border capacity with Germany and Austria are clustered in the project Swiss Roof I.

Is the project in the reference grid?

No

System Needs addressed by the project

Project promoter(s) selected up to 4 system needs that are addressed by their project in a predefined list. Available needs ranged from reduction of price differentials between countries, improvement of system flexibility and stability, enabling cost-efficient connection of high volumes of RES, improvement of voltage stability...
As part of the TYNDP 2020, ENTSO-E released a study investigating cross-border system needs in the 2030 and 2040 horizons.

Need		How the project addresses each need (explanation provided by the project promoter(s))
	Infrastructure to reduce price differentials between EU and/or non-EU countries	This project contributes to lowering the price differentials between Switzerland on the one hand and Germany and Austria on the other hand.
	Infrastructure to address system adequacy deficiencies and/or mitigate the risk of power failures.	This project contributes to the adequacy in view of the nuclear phase-out and the development of renewables and pump hydro storage devices.
	Infrastructure to facilitate and accommodate future scenarios, cross-border flows or loop flows.	This project is located in a highly meshed part of the transmission grid and therefore helps accommodate such flows.

Interconnection targets

In 2017, the Interconnection Target Expert Group proposed alternative indicators to the 15% interconnection criteria for every country and electrified island with a new methodology developed collaboratively between the European Commission, ENTSO-E, ENTSOG, industry, universities and other experts. The methodology is based on three indicators:
1. Price differential between EU countries, with an objective to reduce it below 2 EUR/MWh
2. Ratio between nominal transmission capacity and installed RES capacity, with a target of past 30%
3. Ratio between nominal transmission capacity and peak load, with a target of past 30%

The following maps show the ITEG methodology applied to the TYNDP 2030 scenarios, with the 2020 grid.

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Project Assessment

Transfer capacity increase (National Trends 2025)

	Border	A B	B A
Transfer capacity increase (in MW)	Austria - Switzerland	400	400
Transfer capacity increase (in MW)	Switzerland - Germany	1500	1500
Transfer capacity increase (in MW)	Switzerland - Italy	200	0

Boundary capacity diagram

Network boundary the projects helps mitigate

Italian Peninsula integration

Boundary capacity diagram

CBA results

ENTSO-E has assessed the benefits delivered by each project in 2025 (scenario National Trends 2025) and in 2030 (three scenarios: National Trends, Distributed Energy and Global Ambition). Indicators B1 to B6 were computed by ENTSO-E, while promoters had the possibility to compute and submit so-called project-level benefits (B7 to B10). The benefits must be understood as benefits for Europe as a whole, not for the promoters of the project.
Results are presented per scenario.

Because its planned commissioning date is in 2035 or later, this project has only been assessed in the 2030 scenarios and based on a subset of CBA indicators.

Central scenario: National Trends

National Trends is the central policy scenario of the TYNDP2020, designed to reflect EU member state's National Energy and Climate Plans (NECP), in line with the requirement to meet current European 2030 energy strategy targets.

			Comparison of the COP21 scenarios with NT2030 average result		
	NT2025	**NT2030**	**DE2030 is < or > than NT2030**	**GA2030 is < or > than NT2030**	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M € / year)	max average min	34 33 33	118 111 105	<	<	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	max average min	6 3 0	30 25 22	>	>	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	max average min	17 17 16	58 52 45	<	<	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B4 Non-CO2 emissions (kg/year)

B4a Nitrogen oxides	average	N/A	139	n/a	n/a	ENTSO-E assessment
B4b Ammonia	average	N/A	-8	n/a	n/a	ENTSO-E assessment
B4c Sulfur dioxide	average	N/A	636	n/a	n/a	ENTSO-E assessment
B4d Particular matter 5	average	N/A	6574	n/a	n/a	ENTSO-E assessment
B4e Particulate matter 10	average	N/A	59	n/a	n/a	ENTSO-E assessment

B4f Non-methane volatile organic compounds		average	N/A	6553	n/a	n/a	ENTSO-E assessment
B2a Annual CO2 variation from market simulation (ktonnes / year)		max average min	-1 -130 -260	-792 -908 -1077	< <<	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M € / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	5 10 22	29 65 146	< < <	< < >	ENTSO-E assessment
B2b Annual CO2 variation due to network losses (ktonnes / year)		average	0	0	n/a	n/a	ENTSO-E assessment
B2b_€ Annual Societal cost variation resulting from CO2 variation from network simulation monetised (M € / year)	CO2 price	60€/ ton 100€/ ton 189€/ ton	0 0 0	0 0 0	n/a	n/a	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)		max average min	345 332 320	1463 1312 1182	< < <	< < <	ENTSO-E assessment
B3a Connected RES (MW)	-				n/a	n/a	ENTSO-E assessment

Impact on grid losses

B5 Variation of network losses		average	N/A	0	n/a	n/a	ENTSO-E assessment

(GWh / year)						
B5_€ Variation of network losses monetised (M€ / year)	average	N/A	0	n/a	n/a	ENTSO-E assessment

Security of supply

B6 Annual reduction in Energy Not Served (MWh / year)	max average min		N/A	n/a	n/a	ENTSO-E assessment
B6_€ Annual Socio-Economic Welfare increase resulting from reduction in Energy Not Served monetised (M€ / year)	average	n/a	N/A	>	n/a	ENTSO-E assessment

Scenarios: Distributed Energy & Global Ambition

DE and GA are two scenarios created in line with the COP21 targets to understand the impact on infrastructure needs agains different pathways reducing EU-28 emissions to net-zero by 2050. For these two scenarios, projects were assessed with a subset of CBA parameters.

		DE2030	GA2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	107	105	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	51	34	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	42	47	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-959	-961	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	7 45 130	24 62 148	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	745	1037	ENTSO-E assessment
B3a Connected RES (MW)	-			ENTSO-E assessment

Non scenario-dependent indicator(s)

B8.0 Stability (Transient, Voltage and Frequency Stability)	Transient stability	Voltage stability	Frequency stability	
Beznau - Mettlen (New AC line)	++	++	0	Qualitative assessment by ENTSO-E based on information on the project technology provided by the project promoter(s). This indicator is not dependent on scenarios or time horizons.
Pradella - La Punt (New AC line)	++	++	0	
Bassecourt - Mühleberg (New AC line)	++	++	0	
Mettlen - Ulrichen (New AC line)	++	++	0	

Sensitivity Study: Current Trends

'Current Trends' describes a future where the energy transition is slower than planned.

	CT2030	

Increase in socio-economic welfare

B1 Annual Socio-Economic Welfare (SEW) increase (M€ / year)	average	43	ENTSO-E assessment
B1_CO2 Annual Socio-Economic Welfare increase resulting from CO2 emissions reduction	average	12	ENTSO-E assessment
B1_RES Annual Socio-Economic Welfare increase resulting from RES integration	average	23	ENTSO-E assessment

Reduction of CO2 and GHG emissions

B2a Annual CO2 variation from market simulation (ktonnes / year)	average	-430	ENTSO-E assessment
B2a_€ Annual Societal cost variation resulting from CO2 variation from market simulation monetised (M€ / year)	CO2 price 60€/ ton 100€/ ton 189€/ ton	14 31 69	ENTSO-E assessment

Integration of renewable energy sources

B3 Annual avoided curtailment (RES integration) (GWh / year)	average	434	ENTSO-E assessment
B3a Connected RES (MW)	-		ENTSO-E assessment

Residual impact

Information on the residual impact of the project was provided by the project promoter(s).

Residual environmental impact

Investment	Investment status	Distance (km)	Type of sensitivity
Pradella - La Punt	Under Construction	3	Emerald Site

Residual social impact

Investment	Investment status	Distance (km)	Type of sensitivity
Beznau - Mettlen	In Permitting	47	Sensitivity regarding population density - Land that is close to densely populated areas
Mettlen - Ulrichen	In Permitting	34	Sensitivity regarding population density - Land that is close to densely populated areas

Project Costs

The project costs were provided by the project promoter(s).

	CAPEX (Meuro)	Uncertainty range (%)	OPEX
1259. Beznau - Mettlen	83	10%	0.42
1284. Pradella - La Punt	102	10%	0.51
1287. Bassecourt - Mühleberg	138	10%	0.69
1288. Mettlen - Ulrichen	276	10%	1.38
Total	599		3

Explanation provided by the project promoter on the CAPEX uncertainty range:

1259	unknown outcome of the tendering process
1284	unknown outcome of the tendering process
1287	unknown outcome of the tendering process
1288	unknown outcome of the tendering process