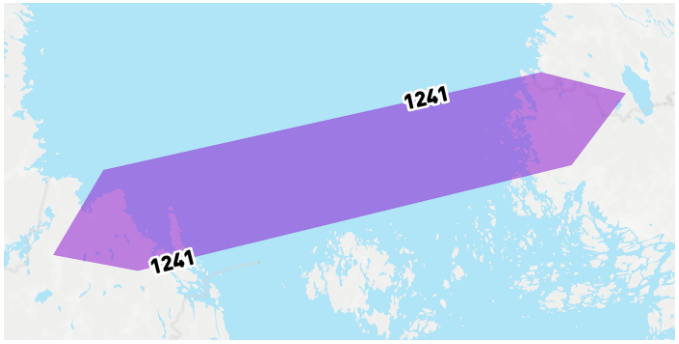
## Project 239 - Fenno-Skan 1 renewal

Renewal of the existing 400 kV HVDC cable interconnection between Finland and Sweden. The projects capacity is estimated to range between 500-800 MW which could mean an updgrade compared to today.

| | |
|---|---|
| Classification | Future Project |
| Boundary | Finland-Sweden (SE3) |
| PCI label | |
| Promoted by | Fingrid;Svenska Kraftnät |




### Investments

| Investment ID | Description | GTC Contribution | Substation 1 | Substation 2 | Present Status | Commissioning Date | Evolution since TYNDP 2014 | Evolution Driver |
|---|---|---|---|---|---|---|---|---|
| 1241 | Complete re-investment of existing HVDC cable | 100% | Dannebo (SE3) | Rauma (FI) | Under Consideration | 2030+ | New Investment | |

### Additional Information

*Svenska kraftnät has published a national development plan in 2015. The purpose of the plan is to be an investment plan for the following ten years, 2016-2025. The investment plan presents a detailed look of the projects Svenska kraftnät intends to realize under the stated time period. The plan is available in Swedish through the following link:*

http://www.svk.se/siteassets/om-oss/rapporter/natutvecklingsplan-2016-2025.pdf (Swedish)

Fingrid has published a national development plan in 2015. The investment plan present a detailed look of the projects. The plan is available in Finnish:

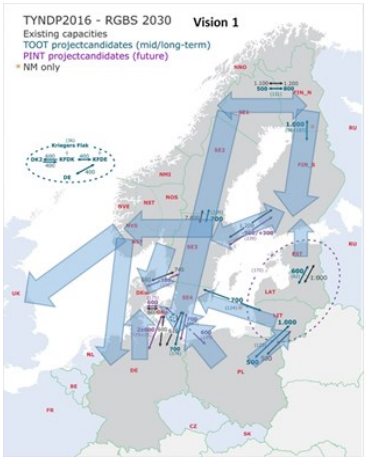
http://www.fingrid.fi/fi/asiakkaat/asiakasliitteet/Kehittämissuunnitelma/Kantaverkon_kehittämissuunnitelma%202015%20-%202025.pdf

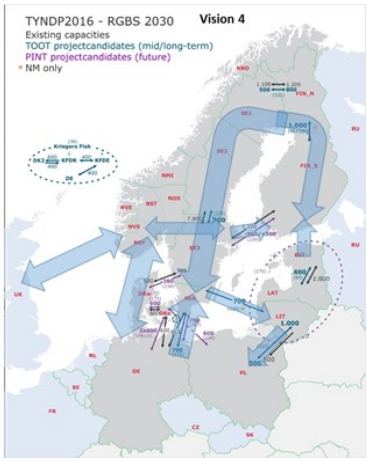
## Investment needs

Fenno-Skan 1 is the older of the two HVDC-connections between Finland and Sweden and is due for reinvestment. It is not yet decided whether Fenno-Skan 1 should be renewed with the same capacity as today (500 MW) or if it should be higher to match Fenno-Skan 2 (800 MW). Evaluation of the need for interconnection capacity between Sweden and Finland is also made by Svenska kraftnät and Fingrid in a separate bilateral study.

The project do not influence the TYNDP-defined main-boundary of the region. However the project candidate maintains 500 MW capacity between Sweden and Finland and if the link is upgraded it increases the capacity with 300 MW. There are several drivers for additional capacity at this border such as:

- System adequacy
- Increased flexibility and market integration in different weather years
- Reduced dependency of Finland on Non-ENTSO-e member countries




## Project Cost Benefit Analysis

This project has been assessed by ENTSO-E in line with the Cost Benefit Analysis methodology, approved by the EC in February 2015.

The indicators B6/B7 reflect particular technical system aspects of projects based on a summation of qualitative performance indicators, in line with the CBA methodology; these cannot be used as a proxy for the security of supply indicator.

| General CBA Indicators | |
|---|---|
| Delta GTC contribution (2020) [MW] | Delta GTC was not checked for 2020 and the 2030 values were considered for SEW, RES and CO2 assessment. |
| | |
| Delta GTC contribution (2030) [MW] | SE3-FI: [500 ; 800] |
| | FI-SE3: [500 ; 800] |
| Capex Costs 2015 (M€)<br>Source: Project Promoter | 500 ±50 |

| | |
|---|---|
| Cost explanation | Early cost estimation. |
| S1 | NA |
| S2 | NA |
| B6 | ++ |
| B7 | ++ |

| Scenario specific CBA indicators | EP2020 | Vision 1 | Vision 2 | Vision 3 | Vision 4 |
|---|---|---|---|---|---|
| B1 SoS (MWh/yr) | N/A | N/A | N/A | N/A | N/A |
| B2 SEW (MEuros/yr) | N/A | <10 | <10 | <10 | 10 ±10 |
| B3 RES integration (GWh/yr) | N/A | <10 | <10 | 10 ±10 | <10 |
| B4 Losses (GWh/yr) | N/A | N/A | N/A | N/A | N/A |
| B4 Losses (Meuros/yr) | N/A | N/A | N/A | N/A | N/A |
| B5 CO2 Emissions (kT/year) | N/A | -200 ±100 | ±100 | ±100 | ±100 |

Cost Benefit analysis in TYNDP 2016 does not take into account different hydrological years, but instead an average hydro year is used. Interconnectors in the Nordic countries give higher SEW benefits in extreme weather years.

Connections to the Nordics can bring potential balancing market benefits in the intraday market which has not been considered in the CBA analysis, the benefits are increased for markets with a lot of wind or hydro as the output can vary a lot from the forecasts.

As the accurate location and project scope are still under investigation, B4 indicator (impact on losses) was not assessed

| Complementary information about the border on which the project is located | Vision 1 | Vision 2 | Vision 3 | Vision 4 |
|---|---|---|---|---|
| Average marginal cost difference in the reference case [€/MWh] | 0.14 | 0.14 | 1.73 | 4.03 |
| Standard deviation marginal cost difference in the reference case [€/MWh] | 1.66 | 1.55 | 9.37 | 12.30 |
| Reduction of marginal cost difference due to all mid-term and long-term projects [€/MWh] | 2.01 | 1.51 | 6.64 | 12.37 |