3.4.26 SWEDEN

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Sector overview

Existing network

- Sweden's national grid comprises around 15,592 km of power lines operating at 400 kV and 220 kV, and around 160 transformers and switching stations.
- Sweden has 16 cross-border interconnections with other countries including Denmark, Norway, Finland, Poland and Germany.

TSO

- Sweden's national transmission grid is owned and operated by Svenska Kraftnät (SvK), a state-owned public utility formed in 1992 after the unbundling of the generation and transmission assets of the former government agency, Vattenfall AB.
- SvK is also responsible for operating the electricity interconnections with the neighbouring countries.
- SvK Group has one subsidiary, Svenska Kraftnät Gasturbiner AB, and seven associated companies in Sweden, Norway and Finland.

Investment drivers

- Majority of the lines and stations are nearing the end of their technical lifetime and need to be renovated/refurbished.
- Investment is also required to enable the integration of the expanding renewable electricity production (mainly from wind energy projects), in line with the Swedish and European energy and climate policy.
- SvK is also focused on preparing the national grid for a common European electricity market and enabling free trade of electricity between the Nordic countries and Continental Europe.

Expected investment

- SvK is expected to invest over SEKXX billion between 2019 and 2027 in the Swedish transmission grid.
- Majority of this investment will be for reinforcements/ reintegration and national as well as cross-border interconnections.

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Historical capital expenditure trends

Investment trends

- Over the last 10 years, the annual investment in the Swedish transmission grid has increased from SEKXXXX million in 2009 to SEKXXX million in 2018.
- The year 2014 witnessed the highest level of investment so far at SEKXXXX million.
- So far majority of the grid investment has been spent on the development of new network. In 2018, SEKXXX million (around 80% of total investment) was spent on new projects, and SEKXXX million was spent on refurbishment.
- Apart from grid investments, in the past 10 years, SvK has invested SEKXXX million on the development of fiber-optic network.

Investment focus

- Expanding and strengthening the grid to enable large-scale wind integration, establishing interconnections with other European countries and improving the reliability of the grid have been the major focus areas for investment.
- Renovation and modernisation projects were also a key component of the capital expenditure in the past 10 years.

Key projects commissioned

- Key recently commissioned projects include:
  - 400 kV Högnäs and Loviseholm substations.
  - Under the Stockholms Ström project, the Danderyd–Jarva and Anneberg–Skanstull lines, and the new 400 kV Anneberg station have been commissioned.
  - A 400 kV AC line between Östansjö and Barkeryd (northern part of SouthWest Link).
  - The Fenno-Skan interconnection between Sweden and Finland and the Nea–Järpströmmen interconnection between Sweden and Norway.

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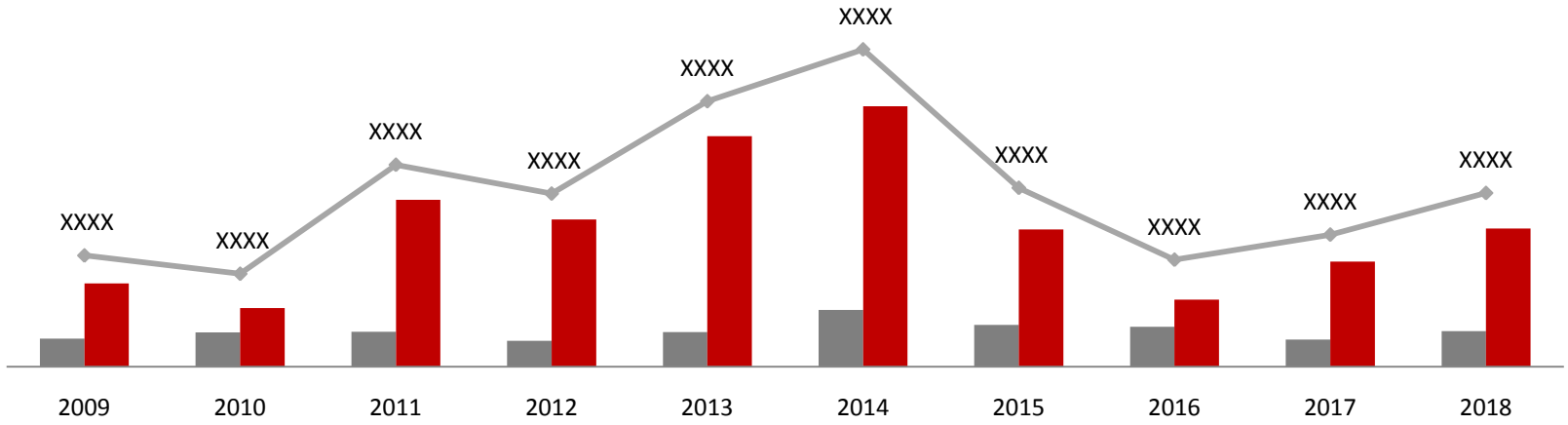
Historical capital expenditure by type

Figure 1: Growth in Sweden's capital expenditure on transmission network (SEK million)



Note: Category-wise break up 2017-18 has been estimated based on past trends; investments include capex undertaken by SvK on its subsidiary company Svenska Kraftnät Gasturbiner AB which operates SvK's gas turbines needed for its grid operations.

Table 1: Sweden's capital expenditure on transmission network by type (SEK million)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
The parent entity										
— Grid investments	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
— Fibre-optic cable investments	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
— Intangible investments	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Total parent entity	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
— of which internal group transactions	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
SwePol link AB	1	1	25	0	0	0	0	0	0	0
Svenska Kraftnät Gasturbiner AB	24	20	24	3	2	22	44	85	104	117
Total investments	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Source: Svenska kraftnät; Global Transmission Research

Future capital investment

Investment drivers

- Key drivers for future capex plans include:
  - The growth in renewable energy especially wind power.
  - European market integration with large number of intermittent electricity generation creating a greater demand for transmission network.
  - Changes in consumption pattern driven by both general electricity consumption and specifically due increased number of data centers in the country
  - Large consumption increases in metropolitan regions require extensive network investments to secure electricity supply to these areas.
  - Decommissioning of nuclear power would increases the need for transmission capacity from north to south of the grid
  - Upgrade and renovation of existing infrastructure.

Expected investment

- SvK envisages an investment of around SEKXX billion between 2019 and 2027 in the Swedish transmission grid.
- Of this, around XX% is targeted for new build and the remaining for renovation and modernisation of assets.
- Of the SEKXXX billion, an estimated X% is likely to be spent on reinvestments.

Key projects

- Key cross border projects include:
  - Hansa PowerBridge I & II interconnector with Germany
  - 400 kV interconnector with Finland
- SvK is also undertaking various domestic projects. Key include:
  - Ekhyddan–Nybro–Hemsjö Transmission Line
  - SouthWest Link (Southern part)
  - Långbjörn–Storfinnforsen Transmission Line
  - Lindbacka–Östansjö Transmission Line
  - Skogssäter–Stenkullen Transmission Line
  - Stockholm Ström Project
  - Greater Stockholm West Project (Storstockholm Väst)

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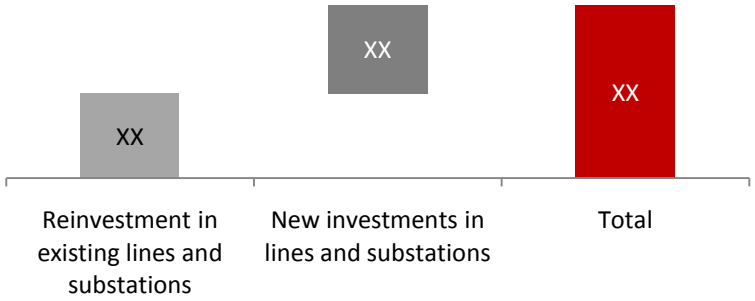
Expected capital investment by type

Table 2: Sweden's planned capital expenditure on transmission network for 2019–27 (SEK billion)

	2019-27
Reinvestment in existing lines and substations	XX
New investments in lines and substations	XX
Total investments	**XX**

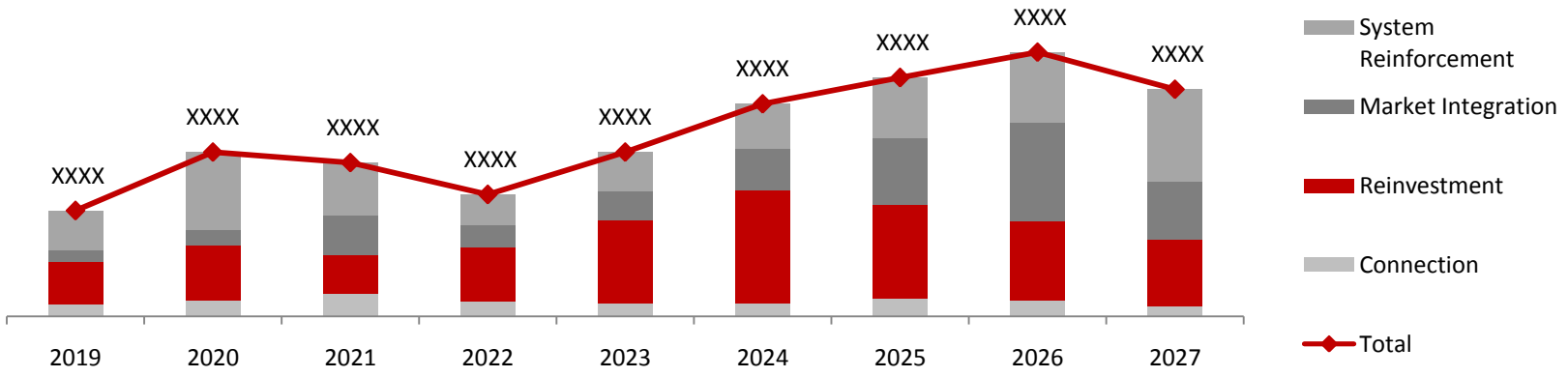
Note : The investment on lines and substations has been estimated based on the project details given in the network development plan 2018–27.
Source: Svenska kraftnät; Global Transmission Research

Figure 2: Sweden's planned transmission capex on reinvestment and new investment 2019–27 (SEK billion)



Source: Svenska kraftnät; Global Transmission Research

Figure 23: Sweden's planned investment on transmission grid for 2019–27, by main drivers (SEK million)



Note : The grid investment based on details given by the network development plan 2018–27.
Source: Svenska kraftnät; Global Transmission Research

Key initiatives and programmes

Table 3: Sweden's key initiatives and programmes

Name	Scope of work	Planned completion
Development of a market design	The plan has recommended that certain market ground rules must be developed in order to be able to balance the system, cope with the output fluctuations and solve grid capacity problems by offering better incentives for electricity users and producers to help create greater flexibility in the system	-
Development of energy storage	The plan seeks to develop energy storage to help improve energy system efficiency under the market- and technology-neutral playing field. It has suggested the government to task Swedish Energy Markets Inspectorate (Ei) to analyse the opportunities and obstacles affecting the establishment and use of energy storage in the distribution grid and propose the measures to overcome those obstacles	-
Residential energy storage scheme	Sweden introduced the residential energy storage scheme wherein it provides several financial incentives to the households for the installation of energy storages systems. It has been introduced to enable better use of the solar photo-voltaic (PV) generation systems and establish smarter and more flexible grids that can contribute to stabilise it against fluctuations in frequency and voltage.	-
Energy storage funding	The government of Sweden, through the Swedish Energy Agency, has recently announced a funding of SVK146 million for the EUR4 billion large-scale lithium-ion battery manufacturing facility in Västerås, to be released across various stages of the project's development up to 2023.	2023

Source: Svenska kraftnät; Global Transmission Research