Norrbotten:

The industrial transition and its socio-economic impacts

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The report is based on a number of open sources and reports, as well as analyses by McKinsey & Company.
Region Norrbotten is responsible for the report's conclusions.
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1. Norrbotten at the heart of the world's green industrial transition

Northern Sweden is right at the heart of a rapid transition to green and fossil-free production methods within global industry, transport and energy systems. This is no longer a vision of the future driven by individual actors, but a current reality in many countries. A tipping point has been reached, with many companies and a clear economic argument driving progress, strongly supported by new and tighter regulations and support across a wide range of countries.

The EU has legislated for a 55% reduction in its emissions by 2030 and full climate neutrality by 2050[1]. The regulations steering us towards these goals, such as the EU Emissions Trading System (EU ETS) with its gradual phasing out of emission allowances, or its Carbon Border Adjustment Mechanism (CBAM), will increase the cost of traditional goods and services with a large climate footprint. Within the foreseeable future, these will thus lose their competitiveness. For example, the cost of today's fossil steel is expected to increase by over 30% by 2035, due to the cost of carbon emission allowances.[2] And alongside all this, companies around the world are setting increasingly aggressive climate goals: more than 4,000 large companies have announced that they are joining the Science Based Targets initiative (SBTi), under which they are committing to deep emission cuts along the whole value chain. Such ambitions, not least among many companies in the automotive industry, are greatly increasing the demand for low-carbon materials and energy. For many products and materials, including green steel and copper, global demand is expected to outstrip supply within the coming decade.[3]

In response to this trend, companies around the world are investing trillions of kronor in new or converted fossil-free production capacity. In many countries, they are receiving extensive government support in the form of subsidies and investment programmes, since governments see the green industrial transition as not only a necessity, but also an opportunity to improve the competitiveness of their own economy. Most notable is the US *Inflation Reduction Act (IRA)*, which provides state support worth around USD 400 billion[4], equivalent to two-thirds of Sweden's GDP, to fund fossil-free energy, green industry and the climate transition. Germany is also investing more than EUR 200 billion in its Climate and Transformation Fund, with targeted investments in fossil-free electricity production, the hydrogen industry and green steel. France's *France Relance* programme includes EUR 30 billion for the climate transition of heavy industry,

new fossil-free electricity generation and the expansion of green infrastructure. More examples of large-scale government programmes can be found in Spain,[5] Canada[6] and New Zealand[7].

Northern Sweden, and Norrbotten in particular, is very well positioned for this industrial transformation, with its numerous, well-recognised competitive advantages. Around 90% of the EU's iron ore production takes place in the counties of Norrbotten and Västerbotten[8], and there is also a surfeit of renewable and cheap electricity: in 2022, the SE1 electricity area had net exports of around 15 TWh of electricity[9] and a spot price that was a sizeable 40% lower than Sweden as a whole.[10] Large companies also pay around 40–50% less for electricity in Sweden than in the rest of the EU, on average.[11] Furthermore, the region has world-leading companies in key industries, and a growing ecosystem of actors, including researchers and suppliers, who are already at the forefront of the green transition.

Based on these favourable underlying conditions, a number of major green industrial projects have been initiated in Norrbotten, in areas such as fossil-free steel, mining and biofuels. These have the potential to become a new economic engine for the whole of Sweden, as well as playing a key role in the climate transition. In addition, they will reduce the need to import fossil fuels, thus increasing Sweden's energy independence. Realising the benefits of these business investments also requires an expansion of social infrastructure at an unprecedented scale and speed: transport and energy systems need to be greatly upgraded, new housing is required for a rapidly growing workforce, and expanded public services and environments must be offered as the population grows. The transition requires a concerted effort by a large number of actors, with major decisions and extensive investments needed in a short timeframe. State, regional, municipal and private actors all have an important role to play in the broad collaboration and may need to find new solutions to manage the transformation at sufficient scale and speed.

Many articles, reports and studies have addressed this issue. The aim of this report is to provide an overview of the current situation and needs, thereby serving as a common factual basis for the decisions that need to be taken by the actors involved at all levels. The report is organised as follows:

Chapter 2 maps out the largest industrial projects taking place in Norrbotten, with a description of each initiative's purpose, scope, expected impact and how far advanced the projects are. An overall picture of the projects as a whole is also presented.

Chapter 3 analyses the socio-economic potential of the initiatives, based on factors such as GDP, public finances, exports and the labour market. It also provides an overview of what impact the transformation will have on the climate and environment, and how different groups and stakeholders are affected.

Chapter 4 provides an overview of various infrastructure and societal investments that are vital prerequisites for the planned or ongoing industrial projects. The need for investment in electricity and electricity networks, transport systems, housing and other public infrastructure and services is described, in terms of when and where expansion is necessary. The chapter also outlines the public finance challenges that may throw up obstacles to the necessary investments.

Chapter 5 brings things to a close by discussing the potential risks and consequences of not investing, and what that would mean for the region and for Sweden as an industrialised nation.

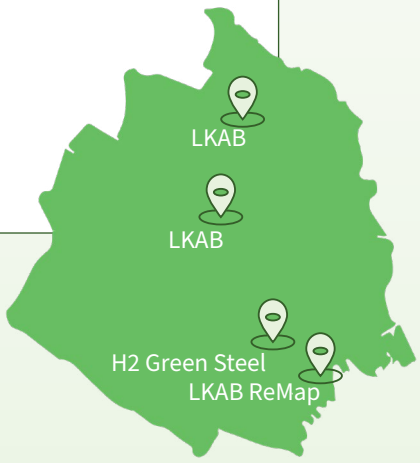
2. Green industrial projects in Norrbotten

A large number of industrial initiatives of various sizes are underway or planned in Norrbotten. The focus of this report is mainly on the largest new industrial investments with a clear sustainability focus that are currently ongoing, taking in completely new industries, expansions and major repositioning by established companies. The table below describes eight major industrial initiatives, mainly in materials and energy, which the report deals with in greater detail.

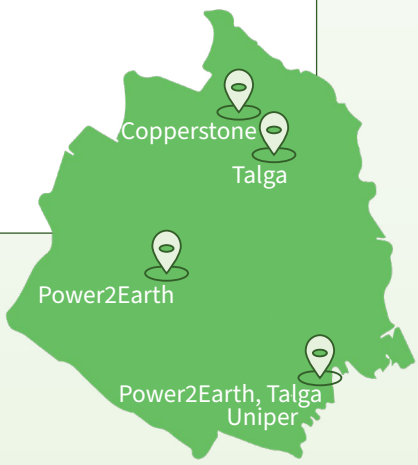
The list of initiatives, investments and projects could be much longer: as a green industrial ecosystem emerges, it is generating direct and indirect follow-on investments. These are not detailed in this report, but are considered in the analysis of the socio-economic impacts. The list also does not include investments already made by actors who have been investing in the transition of their operations for several years, such as Boliden, which in 2023 became one of the world's first mining companies to commission electrified heavy underground transport.[12] Furthermore, the list does not include initiatives or investments outside Norrbotten's borders, even though they could be said to be part of the same greater regional green industry cluster.

The following presentation reflects publicly announced information at the time of writing this report during the period January to March 2024. The pace of development means that the status of individual projects can change at a moment's notice.

Project	Description	Economics and climate
LKAB: Fossil-free direct-reduced sponge iron *Kiruna and Gällivare*	Through Hybrit, its joint venture with SSAB and Vattenfall, LKAB has developed the technology to produce fossil-free direct-reduced sponge iron. LKAB intends to employ the technology in a demonstration plant in Malmberget in 2026, and then gradually ramp up production capacity through more plants (totalling five or six) in Malmberget and Kiruna, with an eventual switch entirely from iron ore pellets to sponge iron. This transition is taking place alongside the development of a new mining standard based on digitalisation, automation, electrification and new ways of working, enabling a fossil-free value chain.[13,14]	**Investment:** SEK 150–400 billion over 15–20 years[15] **Climate:** 40–50 million tonnes of CO_2 cut globally[16]
LKAB ReeMap: Circular industrial park *Luleå*	LKAB's ReeMAP project involves establishing a circular industrial park to recycle mining waste (tailings) from its iron ore production. The company intends to recover phosphorus (which can be used to produce fertilisers) and rare earth elements, as well as producing gypsum and fluorine products, among others, at the industrial park.[14]	**Investment:** Up to SEK 10 billion[14] **Climate:** no information
H2 Green Steel: Fossil-free steel *Boden*	H2 Green Steel (H2GS) is building a plant in Norra Svartbyn in Boden for near fossil-free hydrogen-based iron and steel production. The plant is expected to comprise three integrated elements: 1) hydrogen production, 2) sponge iron production, and 3) steel production. It will be commissioned in two phases: the first phase will start production in 2025/2026 and the second around 2030.[17]	**Investment:** H2GS is investing SEK 75 billion in the plant[18] **Climate:** up to 95% reduction in emissions compared to traditional steelmaking[19]
SSAB: Integrated electric steelworks and rolling mill *Luleå*	SSAB's steel production in Luleå will be converted from a blast furnace, coking plant and existing steelworks into a new integrated electric steelworks with an electric arc furnace, rolling mill and finishing mill. This entails a shift in the value chain, with LKAB taking over the reduction step and delivering direct-reduced sponge iron to SSAB, which will then combine it with scrap iron to produce fossil-free steel.[20]	**Investment:** a total of SEK 50 billion will be invested in the Luleå plant[21] **Climate:** 2.8 million tonnes of CO_2 cut[22]



Project	Description	Economics and climate
Power2Earth: Fossil-free fertiliser *Jokkmokk and Luleå*	Power2Earth is a partnership by Fertiberia, Lantmännen, and Nordion Energi, aiming at producing over 500 000 tons fossil-free mineral fertilizers yearly. The production will be located at Luleå Industrial Park, with hydrogen supplied from Letsi, Jokkmokk.[23]	**Investment:** around EUR 2 billion[23] **Climate:** 1.6 million tonnes of CO_2 cut[23]
Talga: Sustainable anodes for lithium-ion batteries *Vittangi and Luleå*	Talga Resources will produce anodes for lithium-ion batteries for electric cars and electronic components. The plan includes both an anode factory in Luleå and graphite mining outside Vittangi in the municipality of Kiruna. The company has a permit to mine an annual 120,000 tonnes of graphite, and plans to produce 19,500 tonnes of anode material per year.[24]	**Investment:** a total of about SEK 6 billion will be invested in the mine and factory[25] **Climate:** up to 92% lower climate footprint[26]
Copperstone: Sustainable copper mining *Kiruna*	Copperstone Resources plans to reopen the Viscaria mine in Kiruna following a sharp rise in current and forecast demand for copper due to electrification and the green transition. The mine has been closed since the turn of the millennium. With an estimated annual output of 30,000 tonnes, the company is expected to become Sweden's second largest producer of copper.[27]	**Investment:** SEK 4.5–5 billion[28] **Climate:** no information
Uniper: BotnialänkenH2: electrofuels for shipping *Luleå*	BotnialänkenH2 is an initiative to establish a regional hydrogen hub in Luleå to produce 12,000 tonnes of fossil-free hydrogen using wind power, with the hydrogen then used in the regional process industry, converted into electrofuel for shipping, or exported. The project is a joint venture between Uniper, the Port of Luleå, Luleå Energi, ABB and ESL Shipping, with Uniper responsible for construction alongside Hybrit's hydrogen storage pilot in the south-west of Svartön.[29]	**Investment:** around SEK 2 billion[30] **Climate:** 80,000–150,000 tonnes of CO_2 cut[31]



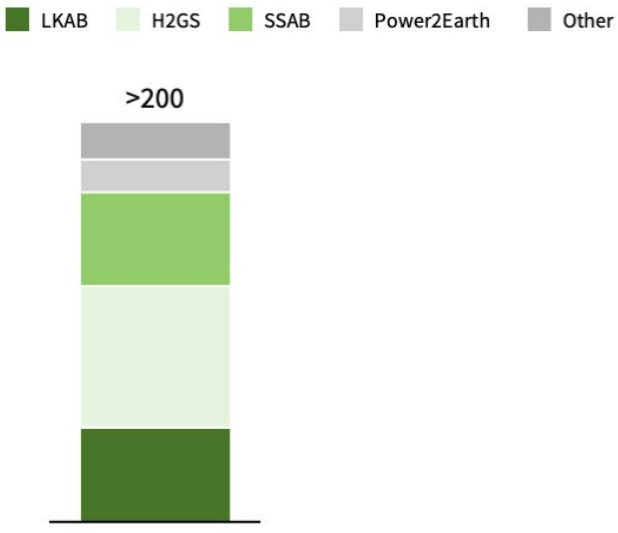
Industrial investments totalling just over SEK 200 billion are thus planned up until 2030 in Norrbotten. In relation to its population size, this means an investment rate almost four times higher than the average in Sweden in a normal year.[32] In some cases, the planning horizon is even longer, and the investments even greater: LKAB has announced extensive investment plans for hydrogen-based sponge iron production, with the plants expected to be phased in between 2030 and 2050.

The major industrial developments are being accompanied by follow-on investments in adjacent industries: subcontractors, companies that manage residual flows or smaller entrepreneurs who establish themselves in the vicinity of the large companies: an ecosystem is emerging. For example, WA3RM in Gällivare plans to utilise the large amounts of surplus heat from LKAB's sponge iron production for greenhouses, fish farms or other biological processes, and a Cleantech Centre is being developed in Boden, where recycling companies and others plan to receive residual streams from H2GS's steel production. These companies' commitments, coupled with a rising population, are causing all aspects of the regional economy to grow, including a wide range of local services, from restaurants and transport to entertainment and personal services.

Industrial companies are planning investments in Norrbotten worth more than SEK 200 billion by 2030

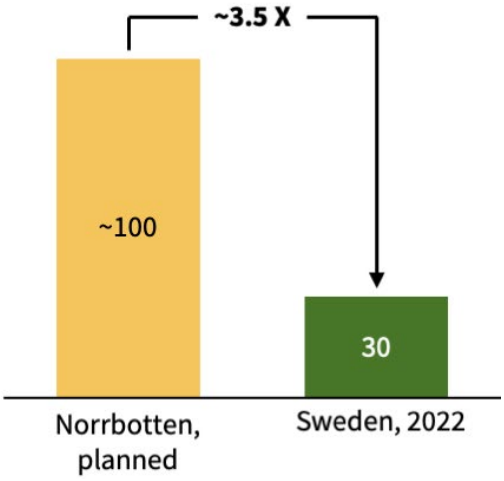
Investments in the announced industrial projects in Norrbotten

SEK billions, cumulative 2022–2030



Unrivalled investment in Norrbotten

Annual industrial investment per capita, SEK thousands 2022–2030



3. Potential for society and the economy

It is not possible to predict with certainty the socio-economic effects of ongoing and planned industrial projects. However, calculations based on the announced plans are able to provide an indication of the magnitude of the impact in various key economic and social areas. All the calculations are based on data, forecasts and targets communicated directly to the public by the companies. The assumptions and calculation methods are presented in Chapter 6 below.

The industrial investments have great socio-economic potential for Sweden and Norrbotten

Indicative impact calculations 2030

Economics	**SEK 80–160 billion**	Potential GDP contribution by 2030 – equivalent to 2–3% of Sweden's GDP and 50–100% of Norrbotten's GRP
	SEK 100 billion	Increased export value – more than doubling Norrbotten's current goods exports
	SEK 15–35 billion	Additional annual tax revenue
Labour market and population	**20,000**	New jobs
	25–30,000	Potential population increase – equivalent to 10% of current population
Climate	**~20 million tonnes**	Additional avoided CO_2 emissions from Swedish exports **– a doubling of Sweden's entire climate benefit**

Socio-economic impact

GDP: The green industrial transition in Norrbotten, and the investments and establishment of new businesses that are now taking place, have the potential to become a growth engine for the whole of Sweden. By 2030, the industrial investments described here could contribute SEK 80–160 billion to Sweden's gross national product (GDP), corresponding to 2–3% of today's GDP or 50–100% of Norrbotten's regional economy. The impact could be even greater in the long term, beyond 2030, when the industrial transition is expected to reach its full potential, with even greater global demand for green goods and materials as a result.

Exports: The planned industries could increase Sweden's exports by around SEK 100 billion by 2030, which represents more than a doubling of Norrbotten's current goods exports.

Taxes: Planned investments could also generate new tax revenue of around SEK 30 billion annually, assuming that the profitability structure of the companies concerned is maintained. Of this tax revenue, more than 80% may accrue to central government through corporate tax, government income tax and VAT, while tax revenue for municipalities and regions depends on where the labour force resides.

Labour market: The green industrial transition could generate around 20,000 new jobs in Norrbotten by as early as 2030. Of these, around 7,000 are direct new jobs announced by the seven companies responsible for the projects examined in detail in this report, in the form of both permanent employment when the industries are operational and temporary jobs during their construction. Most of the jobs are expected to be created in H2GS's steel production and LKAB's sponge iron production. Other jobs will be created in smaller, related ventures, in supply chains, in local ancillary services and in the public sector. Geographically, Gällivare and Boden would see the largest increase in jobs. However, in many sectors the demand for labour may exceed supply, resulting in skills and labour shortages – a challenge for the public sector in particular.

Other social impacts

Population: A further 25,000–3,000 inhabitants could be added to Norrbotten's population by 2030, as a direct result of the new jobs created. This includes both the incoming workforce and their accompanying family members. This increase corresponds to just over 10% of Norrbotten's current population.

It should be noted that these figures only refer to jobs linked to the green industrial investments. Parallel societal developments – not least the joining of NATO and the Swedish Armed Forces' expanded activities in northern Sweden – are expected to bring further new jobs and population growth in Norrbotten. Other publications and analyses have thus produced job and population figures that differ from this report (see also the method explanation in Chapter 6).

Climate: When products and materials are produced fossil-free in Sweden, rather than using conventional methods in other countries, the emissions thus avoided bring climate benefits. The total climate benefit of Sweden's export industry was estimated to be around 26 million tonnes of CO_2 in 2018.[33] The projects currently planned could add another 20 million tonnes to that

figure by 2030, in the form of globally avoided emissions, corresponding to almost a doubling of Sweden's current climate benefit, and to 40–50% of Sweden's territorial emissions of about 45 million tonnes of CO_2 in 2022.[34] By 2050, when LKAB's sponge iron production is expected to reach full capacity, the figure for avoided emissions could reach 50–70 million tonnes of CO_2.

These calculations are general and in some respects simplistic: they take limited account, for example, of what other production or jobs could be created in an alternative scenario without investment. Nevertheless, they clearly point to several potential major benefits for the economy and society, and can provide guidance in deep-dive analyses and specific supporting arguments. Such analyses should also take into account the broader impacts on actors and stakeholders in society, both positive and negative.

Thus, while the expected impact of green reindustrialisation is positive for society overall and on many important fronts, it must be done in a way that takes into account and manages the conflicting objectives it inevitably entails in other areas: rapid economic growth drives up housing prices and can create labour shortages, not least for the public sector; global climate benefits are offset by local environmental impacts; reindeer husbandry and statutory indigenous rights must be taken into account; there are both synergies and conflicting objectives in relation to national defence and security interests; and so on.

The table below summarises a number of key factors and impacts that need to be addressed, many of which are already the subject of public debate, investigations and formal processes.

> "The green industrial transition could generate around 20,000 new jobs in Norrbotten as early as 2030. Of these, around 7,000 are direct new jobs announced by the seven companies responsible for the projects examined in detail in this report."

Impacts and effects of green new industrialisation in Norrbotten on different actors and areas

General view

Positive impact · Risk · Negative impact · Mixed impact

Public finances

- Generally positive in the long run
  - Major contribution to GNP
  - Increased tax revenues
  - Major investments and costs for public services in the short term
- Economic risks of a failed industrial transition

Local business

- Increased demand for local services, especially in construction and engineering
- Improved local infrastructure and services
- Risk of shortages and delays in certain services and of labour shortages

Energy market

- Lower imports of fossil fuels
- Sharp increase in demand
- Risk of higher electricity prices across the country
- Risk of need to import electricity

Housing market

- Significant expansion necessary/possible
- Short-term risk of housing shortages
- Higher housing costs
- Higher construction costs and lead times

Labour market

- Large increase in jobs and employment
- Demand exceeds supply
  - Higher salaries/wage costs
  - Competition for both highly skilled and low-skilled workers

National security

- Some investment synergies with defence in areas such as transport infrastructure
- Trade-offs and conflicting objectives regarding certain investments, wind power etc.
- Impact on energy independence

Climate

- Much lower local and global emissions from fossil-free industry

Nature & biodiversity

- Negative local impacts due to land use and local emissions
- Potential positive global impact through substitution

Reindeer husbandry

- Local impact due to land use

Public health

- Positive (reduction of particulate emissions, etc.) and negative (noise, etc.) local impacts
- Potential positive global impact through substitution

4. Enabling public investment

In many respects, the large-scale projects involve a societal transformation that will affect and place demands on far more stakeholders than the companies directly involved. As demand for electricity, housing, transport and public services increases, this creates a considerable need for investment in public services and infrastructure.

The table below summarises the electricity and labour requirements reported by the companies for the projects included in this summary, as well as the transport infrastructure deemed most critical to ensure the necessary logistics.

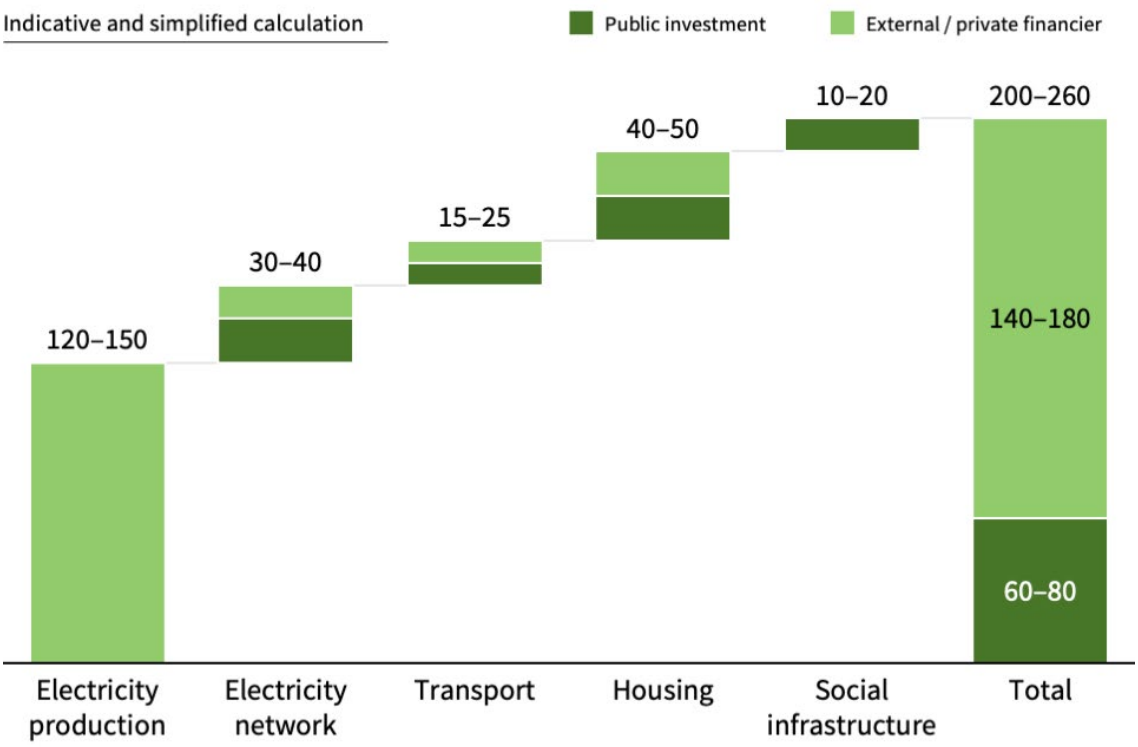
Project	Electricity consumption	Jobs	Transport needs
LKAB: fossil-free direct-reduced sponge iron *Kiruna and Gällivare*	5 TWh/year is required for the first plant.[35] The power demand will then increase gradually and may reach 70 TWh/year by 2050[36]	150–200 jobs at the first plant, no information about the other plants. 2000–3000 jobs over 20 years in renovation and construction[37]	Capacity increases on the Malmbanan rail line are crucial for the planned boost in ore mining[16] Capacity increases in the Port of Luleå and the shipping lane are required for greater movements of ore[38]
LKAB ReeMap: Circular industrial park *Luleå*	2.5 TWh/year expected demand once park is fully developed[39]	500 jobs once the plant is operational, no information on jobs during the construction phase[14]	Capacity increases on the Malmbanan rail line are vital to enable transport of mining waste
H2 Green Steel: Fossil-free steel *Boden*	10 TWh/year in phase 1 from 2026; 13–17 TWh/year in phase 2 before 2030.[40] Power allocated for phase 1 and in queue for allocation for phase 2[41]	1,500 jobs in phase 1; 2,000 jobs in phase 2, plus 4,500 temporary jobs during the construction phase[42,43]	Capacity increases on the Malmbanan rail line are crucial for ore deliveries[44] Expanded all-weather terminal in the Port of Luleå necessary for phase 1. Malmporten project and others important for phase 2[43]
SSAB: Integrated electric steelworks and rolling mill *Luleå*	3 TWh/year is needed in addition to current use and power has been allocated[45,46]	150 new jobs in the operation, no information on jobs during construction phase	Indirectly dependent on the Malmbanan rail line as sponge iron will be delivered from LKAB. Dependent on the construction of an all-weather terminal at the Port of Luleå and greater capacity at the Port of Luleå for steel exports[47]
Power2Earth: Fossil-free fertiliser *Jokkmokk and Luleå*	4–5 TWh/year is needed from the start of production in 2028, but no power allocation as yet[48,49]	500 jobs when the plant becomes operational in 2028, and around 2,000 during the construction phase 2024–2028[50]	Important to increase capacity at the Port of Luleå to enable fertiliser exports when more people want to use the port[51]
Talga *Vittangi and Luleå*	8 MW is needed for the mine and 40 MW for the factory, corresponding to about 0.4 Twh/year, assuming 8,000 operating hours at full power[52]	60 jobs are expected to be created in the mine and 150 in the factory in Luleå.[52] Hundreds of jobs during the construction phase[53]	Mainly in need of local road infrastructure as most of the transport will be by truck[54]
Copperstone *Kiruna*	70 MW is needed,[55] corresponding to about 0.5 Twh/year, assuming 8,000 operating hours at full power	250 jobs in the operation.[56] Around 500 jobs during the construction phase in 2025–2026.[57]	Need for some capacity on the Malmbanan rail line and possible requirements at the Port of Luleå, depending on the nature of the customer agreements[58]
Uniper *Luleå*	150 MW in phase 1 and 250 MW in phase,[30] corresponding to about 1.2–2 TWh/year, assuming 8,000 operating hours at full power	150 jobs in the operation.[59] No information on the number during construction	Increased capacity at the Port of Luleå is vital to build demand for Uniper's ship fuel[30]

Substantial investment is required: by 2030, a total of SEK 200–260 billion could be needed to establish the necessary infrastructure, with new electricity generation accounting for more than half. Increasing the capacity of the electricity network also accounts for a significant share of the investment requirement, followed by housing, transport infrastructure and other social infrastructure.

It is difficult to calculate the exact distribution of investments between the public and private sectors, as in several categories a combination of actors may take the lead. As a rough guide, the public sector is estimated to account for around a third of the investment. This includes public enterprises and other publicly owned fee-financed activities, but not investments that would be carried out by state-owned companies operating on a commercial basis in competitive markets.

Investment in enabling infrastructure

SEK billions, cumulative to 2030



Electricity production

Need: Based on announced plans and needs, the industry's total electricity demand could increase by 40–50 TWh by 2030, a five-fold increase from the current consumption of ~10 TWh in Norrbotten. Fully meeting the increased electricity demand (i.e. ramping up electricity production in pace with demand, so that SE1 can maintain its current energy balance) would require investment of SEK 120–150 billion in new electricity production.

Current situation: Less than 5 TWh of new generation capacity is confirmed to be in the pipeline (projects with both permits and investment decisions). Another 5–10 TWh are currently in the process of obtaining environmental permits and could be added by 2030.[60] Other planned projects are not expected to be up and running by 2030.[61]

In a scenario where only the planned wind power production in the county (10–20 TWh) is realised before 2030 – one third of the expected demand – while all the industrial projects are realised and become operational, electricity area SE1 would theoretically go from a surplus of 15 TWh in 2022[9] to a deficit of around 20 TWh in 2030, all other things being equal. And if electricity demand increased at a faster pace than supply, the electricity price would also be affected. Sharp and persistent increases in electricity prices risk damaging the business case for many industrial projects.

Electricity network

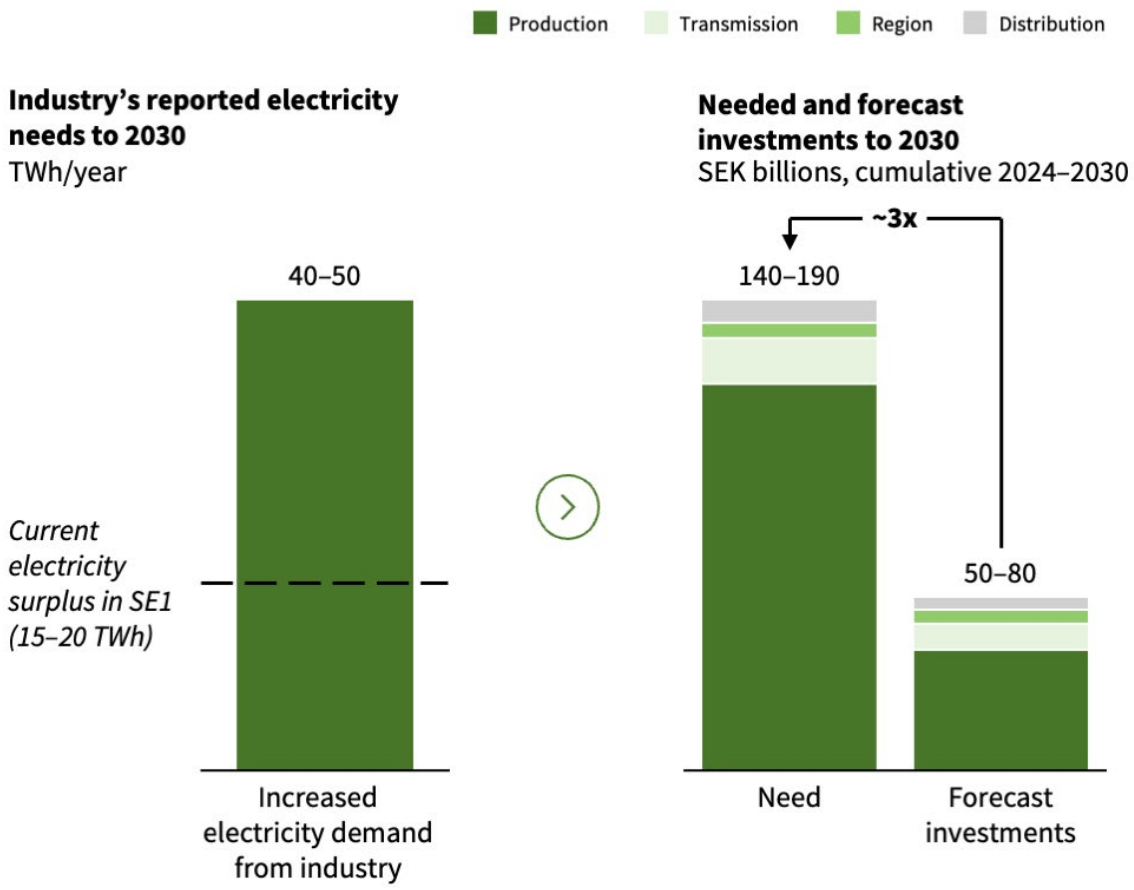
Need: Based on previous reports, the increased load in the different levels of the electricity network will require investment of an estimated SEK 30–40 billion in electricity network expansion by 2030.[62] Half of this is expected to be needed for the expansion of the transmission network (national grid) by 2030, to handle higher loads within electricity area SE1 and across its borders, for example to SE2 and Finland. The other half is expected to be needed for new investments in regional and distribution networks, not least to connect up industries and growing communities due to the influx of new workers. The uncertainty regarding the required investment is governed partly by the extent to which industrial projects and new electricity generation are realised, and partly by the fact that the need is spread across a number of network areas and network owners, whose individual investment plans are outside the scope of this work.

In an analysis, Svenska Kraftnät states that electricity network expansion could be replaced in part by new hydrogen pipelines, in those areas where the electricity demand relates to hydrogen production: “a hydrogen pipeline [may] be vital in meeting the hydrogen demand required to implement the plans that exist, for example for the production of fossil-free steel using hydrogen in northern Sweden. Gas pipelines can transport larger amounts of energy per unit area and also provide an energy flow that is independent of flows in the electricity network, creating more degrees of freedom for the energy system as a whole. Coherent planning of the expansion of the transmission system and a future hydrogen infrastructure that includes hydrogen pipelines is therefore essential.”[63]

Current situation: Through the Fossilfritt Övre Norrland (FÖN) investment package, national grid operator Svenska Kraftnät is making targeted investments that will facilitate the industrial energy transition in northern Sweden. The programme, comprising 11 projects with funding of SEK 10 billion, is also a pilot for Svenska Kraftnät’s new working method, which aims to halve lead times – a power line should now be in operation within seven years of conception rather than the usual 14.[64] As a result, major progress has been made in the expansion of the transmission grid, and several of the most critical projects are expected to be completed on time. Concrete initiatives have also been announced for the regional networks, including Vattenfall’s plan to invest SEK 3.6 billion in Norrbotten by 2025 to upgrade the regional network around Luleå and provide power for the upcoming industrial commitments in Hertsöfältet.[65]

ACCESS TO ELECTRICITY: Investment need is ~3x greater than forecast initiatives

Indicative summary and analysis



However, the situation remains highly complex with unresolved issues, and not all the power requested by industrial companies has been allocated.[66] There are also no concrete plans for hydrogen pipelines that might fully or partially replace electricity network expansion (see above).

Housing and social infrastructure

Need: There is some uncertainty about the exact population trends and where the need for housing and social infrastructure will be greatest. There are already significant skills shortages in several sectors, which may be further exacerbated by a lack of housing in the locations where skills are needed. Based on the new job opportunities reported by the active companies, and a resulting population increase of up to 25,000–30,000 people, over 10,000 new homes may need to be built in Norrbotten by 2030 to meet the demand arising from these investments.

This demand is expected to shift over time and between locations, and the exact distribution is difficult to predict. The temporary jobs involved in building new facilities, or redeveloping existing ones, will gradually be replaced over the period in question by permanent jobs in the

operational industries and associated services. This raises the question of how temporary accommodation can be converted into or replaced by permanent housing, and how costly and unsustainable "fly in, fly out" solutions can be avoided over the long term. Temporary service needs are also expected to shift between cities: LKAB is expected to need 2,000–3,000 people over a period of 10–20 years for the construction of the new sponge iron plants, starting in Gällivare where the first plants are being built. After 2030–2035, the need may then pivot more towards Kiruna.[37]

Up until 2030, the demand for housing is thus expected to be greatest in Gällivare and Boden, driven by LKAB and H2GS's new facilities, followed by Luleå and Kiruna. The required forms of housing vary and demand can to some extent be met with contractor accommodation in the short term, but there is judged to be a major need for new permanent housing. Based on standardised construction costs, the cost of building housing is estimated at around SEK 40–50 billion over the period to 2030.

Public social infrastructure needs to be expanded at the same rate as housing, from the physical infrastructure directly linked to the municipalities' growth – water, waste, local roads, etc. – to public services such as schools, health and social care provision, emergency services and public cultural and recreational facilities. SEK 10–20 billion in new investment is estimated to be needed for such public infrastructure. The expansion of what the municipalities and regions need to provide will bring significant increases in operating and personnel costs. These are not quantified here, but are expected to have a major budgetary impact.

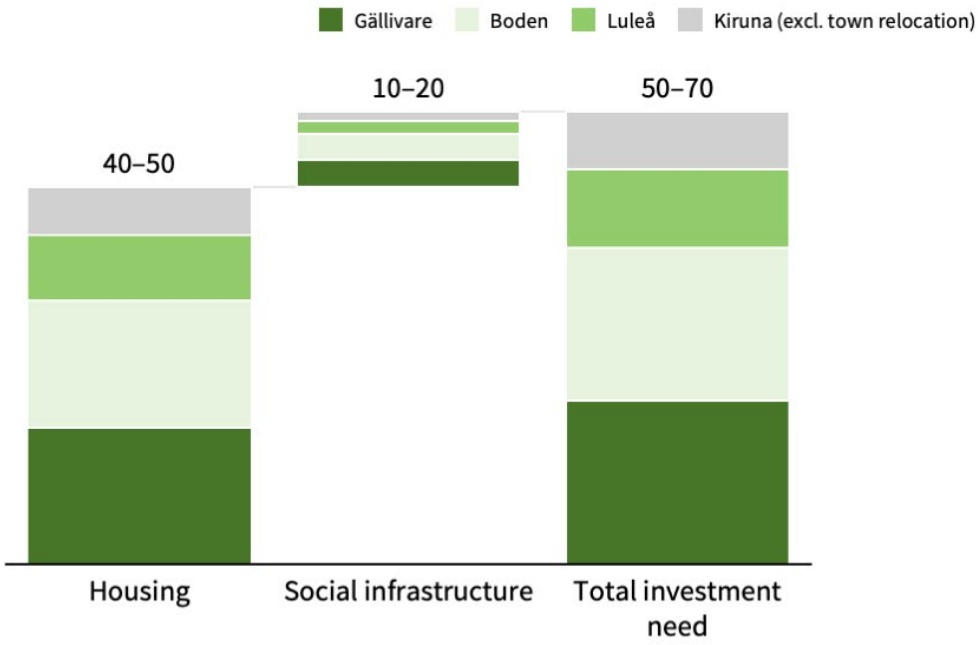
It is worth reiterating that these estimates relate to the needs directly associated with green industrial projects. Other factors (such as the expanded activities of the Swedish Armed Forces) are not taken into account in this analysis, which partly explains why other analyses have produced higher figures for housing demand. For example, government analyst Peter Larsson pointed to a possible population increase of 100,000 inhabitants jointly in the counties of Västerbotten and Norrbotten over a 15-year period.[67]

Current situation: The rate of newbuild construction in Norrbotten is high. The number of housing starts in the Region almost doubled between 2019 and 2023: just over 1,000 homes were started in 2023, and planning permission was granted for around 2,700 more.[68] Per 1,000 inhabitants, 3.8 homes were started in Norrbotten in 2023, compared with 2.5 for Sweden as a whole. However, the rate of construction has slowed since 2022, and companies and municipalities are unanimous in reporting that the pace of housebuilding and urban development is too slow compared with demand, which risks creating a critical bottleneck – a view shared by the government analyst.[67] Planning processes have been accelerated in many cases, but even where permits and land allocations are in place, construction projects have been cancelled or postponed. Uncertainty in risk and profitability calculations has increased in 2022–2024 due to rising interest rates, inflation and a weakening economy, and housebuilding has slowed across the country as a result.

HOUSING & SOCIETY: SEK 50–70 billion may be needed for housing and social infrastructure

Preliminary

Investment need for the development of sustainable communities by 2030, by municipality
SEK billions



Transport infrastructure

Need: Three large-scale transport infrastructure projects have been identified as being of particular importance in enabling transport and logistics flows for new green industry in Norrbotten. Firstly, a major increase in capacity is required in the Port of Luleå, not least to cope with increased volumes from the iron and steel industry.[69] Parts of the port development, such as the expansion of an all-weather terminal, may need to be in place as early as 2025 to enable the handling of weather-sensitive steel products ahead of H2GS's planned start-up.[42] Secondly, upgrading of the Malmbanan rail line between Luleå and Riksgränsen and double-tracking on the same line between Luleå and Boden are needed to enable the transport and sale of LKAB and H2GS's planned production: the freight transport needs announced by the companies would exceed the Malmbanan line's total capacity on the Luleå–Boden route by 2030. In this context, it can be noted that the transport needs of the Swedish Armed Forces and NATO also require increased capacity on the Malmbanan line following Sweden's entry into the defence alliance.[70] Thirdly – with a slightly longer timeframe – the expansion of the North Bothnia Line between Umeå and Luleå is considered a key factor in developing public transport and an integrated Norrland coast as the population grows. These three projects are expected to require investment of around SEK 15–25 billion by 2030.

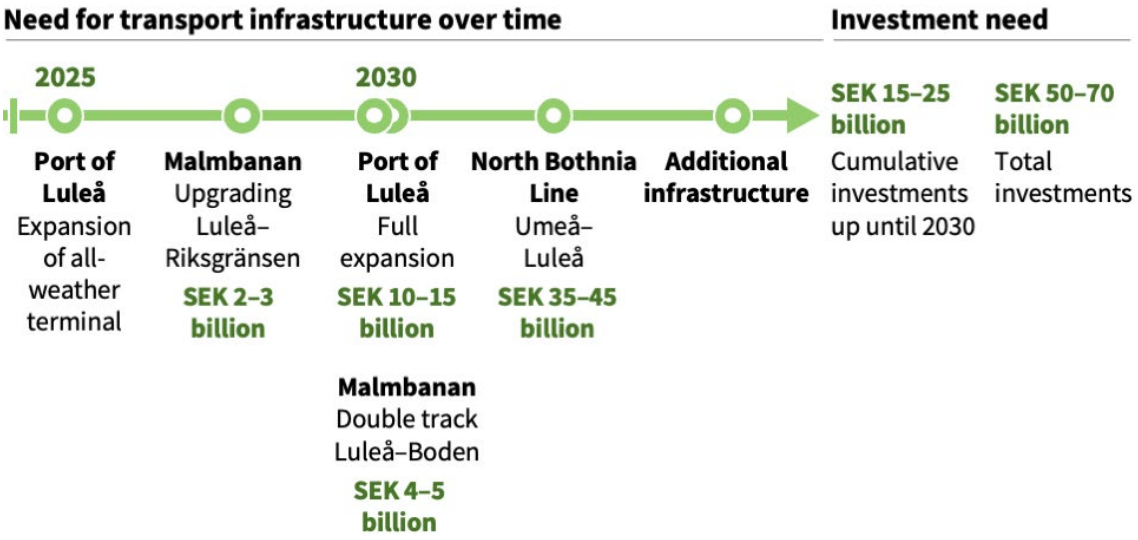
The total investment needed beyond 2030 is estimated at SEK 50–70 billion, mainly driven by the expansion of the North Bothnia Line (the majority of which is being built in Västerbotten). Added to these large-scale projects are smaller initiatives to expand and upgrade regional and municipal transport routes.

Current situation: The Swedish Transport Administration's National Plan for Transport Infrastructure 2022–2033 was adopted by the Government in 2022. Regarding Norrbotten, it specifies a number of measures, investment needs and timetables, including a dozen capacity-increasing measures along the Malmbanan line on the Luleå–Kiruna section, double-tracking on the Luleå–Boden section, capacity improvements for the shipping lane at the Port of Luleå, and the three stages of the North Bothnia Line. In a series of decisions, the Government has also instructed the Swedish Transport Administration to analyse in greater depth the possible consequences of businesses setting up in the counties, and to identify any scope for accelerating the timetable to avoid bottlenecks in the transport infrastructure.[71] In these analyses, the Swedish Transport Administration has made the assessment that commissioning the double track could not take place until 2033, despite the expectation that freight transport needs will exceed available capacity by as early as 2030. Other capacity-increasing measures on the rail line up to Riksgränsen, which according to the base scenario in the National Plan for Transport Infrastructure will be completed in 2035, may also become a bottleneck due to reported needs in 2030.

On 14 March 2024, the Government instructed the Swedish Transport Administration to take measures to prioritise the upgrading of the Malmbanan line between Luleå and Kiruna, and to investigate a range of financing solutions and measures to reduce the overall investment cost.[72]

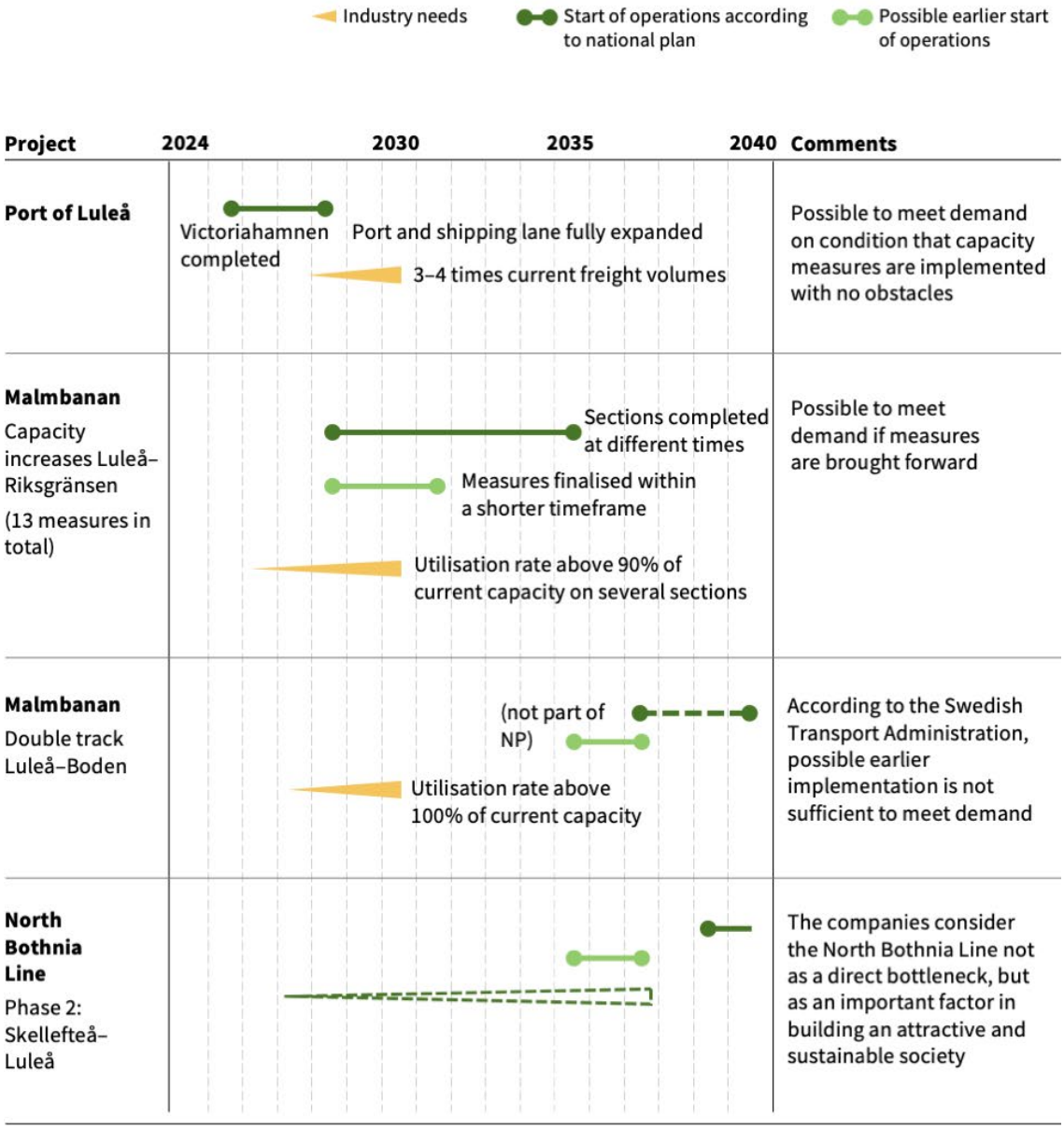
Current expansion plans for the Port of Luleå are deemed sufficient to meet the needs if they are implemented according to the set timeline. According to the National Plan, the extension of the North Bothnia Line's third and final stage, between Skellefteå and Luleå, is to begin between 2028 and 2033, and it is expected not to open to traffic until around 2040. However, the Swedish Transport Administration's analysis indicates that an earlier start could enable operations to begin around 2036 if the project is given priority.

TRANSPORT INFRASTRUCTURE: Industry's need for increased transport capacity could require investments of 15–25 billion SEK before 2030



TRANSPORT INFRASTRUCTURE: Earlier measures on Malmbanan necessary to avoid bottlenecks

Indicative analysis based on the Swedish Transport Administration's policy analysis regarding transport infrastructure



Challenges despite socio-economic benefits

As shown in Chapter 3 above, there is a great deal of socio-economic potential in the new industrial investments in Norrbotten. The direct potential for public finances is also significant: a simplified calculation indicates potential cumulative new tax revenues of SEK 80–100 billion between 2024 and 2030, and annual tax revenues of around SEK 30 billion year on year from 2030. However, as shown in the previous paragraphs, extensive public investment is required to make this possible: it is estimated that the public sector will need to provide SEK 60–80 billion of the infrastructure investment before 2030.

Although the overall economic calculation appears to be favourable for the public finances, implementation of the investments poses several challenges.

Firstly, there is an asymmetry between the actors that have to carry out the investments and the actors that benefit financially from them. A rough calculation indicates that municipalities, including municipal housing companies, need to bear 30–50% of the investment cost. At the same time, according to a simplified calculation of the return on investment, more than 80% of the long-term tax revenue may accrue to the state, mainly through corporate tax, VAT and national income tax.

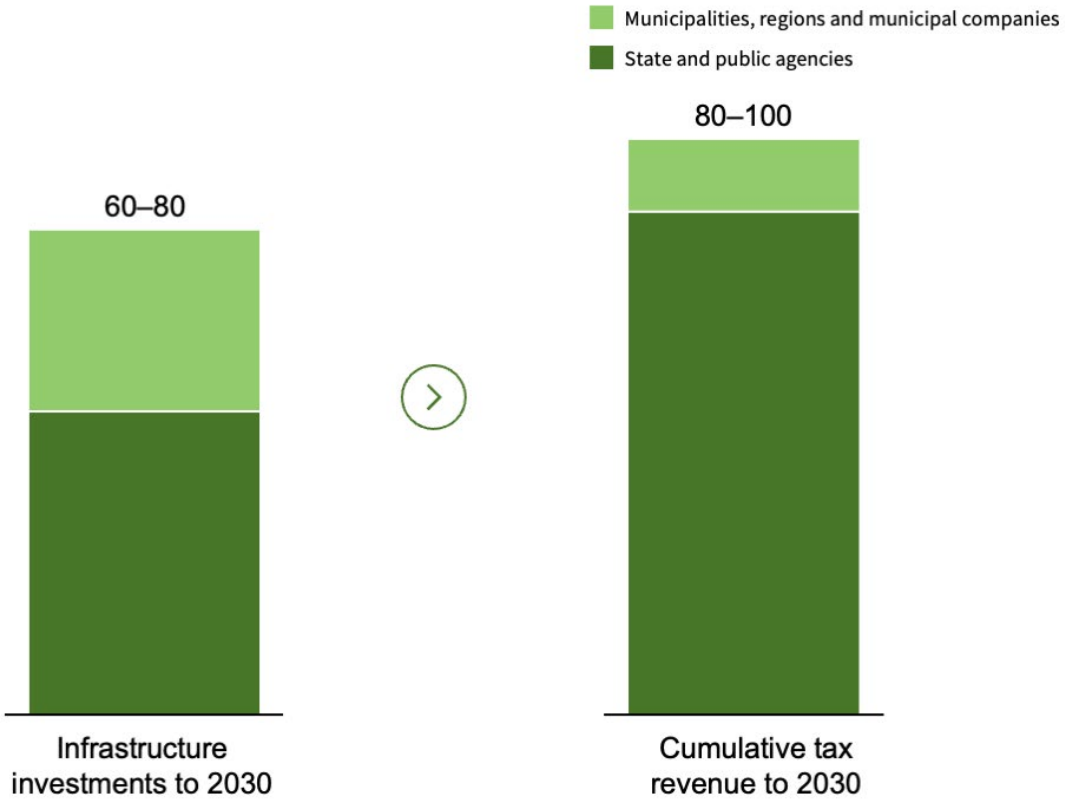
Secondly, as with most investments, there is a time lag between the investment cost and the tax revenue it generates. This is particularly problematic for municipalities facing major investments in expanded public infrastructure, as the Local Government Act (2017:725, Chapter 11, Section 12) stipulates that a municipal budget deficit must be corrected within three years. To enable industrial expansion and migration, investments need to be made in the near future, and even if everything goes to plan, the economic potential may only be realised over a time horizon of 5–15 years.

“To enable industrial expansion and migration, investments need to be made in the near future, and even if everything goes to plan, the economic potential may only be realised over a time horizon of 5–15 years.”

Public investment could bring in sizeable tax revenue

Illustrative and simplified calculations

Public investment need and potential tax revenue, SEK billions 2030



Thirdly, large-scale investments in expanded infrastructure entail a financial risk for municipalities and public actors, depending on when and on what scale the industrial investments will be made. As this report has shown, implementation depends not only on the companies' own decisions and capacity, but also on other actors – electricity producers, network companies, municipal and state authorities – being able to create the necessary conditions at the necessary time (see fact box below). This complexity increases the difficulty of forecasting population growth, for example, and increases the risk inherent in public investment.

Enablers of the transition

The industrial transition does not just require major investment by individual companies or public authorities. When it comes to enabling the large-scale development and expansion of new industries and facilities, energy production and infrastructure, a substantial number of public and private stakeholders are involved in the processes of planning and investigation, applications, permits, consultation and dialogue, decision-making, implementation, operation and oversight of the projects concerned.

This multitude of stakeholders and their interdependencies, coupled with the lack of transparency and coordination in relation to the plans and activities of different actors, contributes to longer lead times and duplication of work. A catch-22 situation can arise, where each actor is dependent on another to take action or publish information, in order to move forward or be confident about taking the next step in their investment.

Conversely, cooperation and transparency between actors can achieve major improvements with minor investment. AGON (Accelerad Grön Omställning i Norrbotten) is a central forum set up by the County Administrative Board for information exchange and joint initiatives, which brings together several of the key industries and authorities at local, regional and national level. At local level, there are plenty of good examples of cooperation between public and private actors on particular industrial and energy projects, where bringing the stakeholders together in one room has helped to resolve bottlenecks and find new ways forward.

The figure below summarises and illustrates the actors most central to the industrial and public investment processes described here, and the roles they play.

Mapping of actors and their role in the establishment of new infrastructure

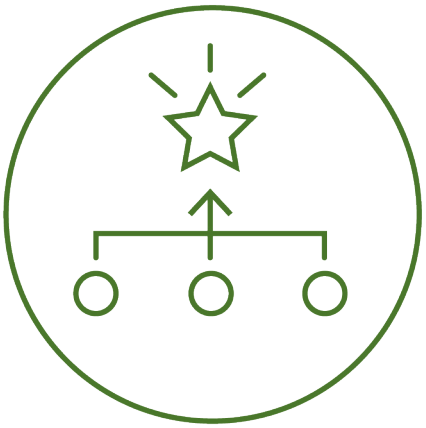
Overview

Central actor · Interested party · Plan/schedule · Give permission · Build · Operate

		Municipality	Region	County Administrative Board	Swedish Transport Administration	Svenska Kraftnät	Other authorities	Private or state-owned companies
ELECTRICITY	New industrial operation	Detailed development plan, land allocations, planning permission, etc.	Overall responsibility for regional economic development	Licensing authority for: environmental permits, water activities, conducting certain types of business, waste management, etc. Coordinates the activities of national authorities in the county		Manages cases relating to power allocation and electricity network connection	Comprehensive plans, water and sewage plans, expansion of quarries and similar are referred to the Swedish Armed Forces	Planning, expansion and operation. Permit application
ELECTRICITY	Electricity network	Distribution networks owned by municipal companies				Develops and manages the national grid and its network connections. Responsibility for electricity	Ei1 issues concession permits Sea, aerial and underground cables are referred to the Swedish Armed Forces	Responsible for regional and distribution networks
ELECTRICITY	Electricity production	Land issues, right of veto, e.g. on new wind power					Tall objects such as wind turbines must be referred to the Swedish Armed Forces	Build and operate
INFRA	Roads	Responsible for local roads			Overall responsibility for the national road network		National and European highways and roads in impact areas are referred to the Swedish Armed Forces	
INFRA	Rail	Responsibility for detailed planning of local infrastructure e.g. the Svartbyn infrastructure area in Boden			Overall responsibility for the national rail network		All rail plans are referred to the Swedish Armed Forces	Operate passenger and freight transport services Own private rail services
INFRA	Port	Planning monopoly; construction and operation by municipal companies			Responsibility for strategic maritime issues such as the location of ports		The Swedish Maritime Administration is responsible for operational maritime issues such as the capacity of a shipping lane	Build and operate ports via contracts with the municipality
SERVICES	Housing	Planning responsibility for housing Own production through public housing system		Promotional activities in areas such as environmental objectives, energy and the climate, gender equality and public health			Comprehensive plans and water and wastewater plans are referred to the Swedish Armed Forces	Build and operate housing
SERVICES	Municipal services	Plans, builds and operates water and sewerage systems, schools, care services, etc.	Public transport (shared responsibility with municipalities)					
SERVICES	Health care		Overall responsibility for health care					

+ Financiers
have a key enabling role at all stages

1. Ei = Swedish Energy Markets Inspectorate



5. Conclusion: success factors for green industrialisation in Norrbotten

Companies and public actors have set a high level of ambition for green industrialisation in Norrbotten through the projects and initiatives currently underway. There is great potential for the region, and for Sweden's economy, labour market and climate footprint as a whole. However, this report, like several previous publications and analyses, identifies a number of dependencies, bottlenecks and as yet unmet infrastructure needs that will have to be resolved in order to fully realise this potential.

If the expansion of electricity generation and transmission capacity does not happen at sufficient speed and scale, or if industrial companies do not obtain network concessions in time, the risk is not just about investments being delayed; access to green, cheap electricity is a prerequisite for industry to expand and scale up.

Slow or insufficient expansion could also limit industries' access to raw materials or their ability to ship products, risking delays to plans and capacity constraints, at great cost to business and society.

Insufficient investment in housing and social infrastructure not only threatens the supply of labour to businesses, but also makes it difficult to build a sustainable and attractive community. If municipalities fail to build attractive communities, there is a risk of costly and unsustainable "fly in, fly out" scenarios, greater labour turnover and lower tax revenues, in addition to the cost in terms of lower quality of life for citizens.

Excessively time-consuming planning and authorisation processes can also lead to delays in the start of production or the cancellation of activities. This is true at all levels, from housing construction to electricity generation – not least new wind power – network expansion and new factories.

The financial stakes are high as industry in Sweden and Norrbotten switches to green and fossil-free production. In addition to extensive private investment, significant taxpayers' money has already been invested to enable the transition and realise its potential. The great potential upsides have been described in this report. The issue is shaping the political and economic landscape in many countries: in addition to the United States' large-scale initiatives and subsidies linked to the *Inflation Reduction Act (IRA),* Germany, France, Spain and others have introduced wide-ranging programmes to attract green industrial investment and support domestic companies. Any loss of momentum in the Swedish transition thus also has a downside from the perspective of global competition: as green production becomes the international norm, driven by tougher regulations and higher costs for emissions, and as other countries invest in supporting and expanding green industry on a large scale, falling behind would put Sweden and Swedish industry at risk of losing companies and competitiveness.

Mobilising resources and unlocking the potential of the transition instead would enable Sweden to build on its global leadership and create momentum for green industry the world over, to the benefit of both the economy and the climate.

"Mobilising resources and unlocking the potential of the transition instead would enable Sweden to build on its global leadership and create momentum for green industry the world over, to the benefit of both the economy and the climate."

6. Sources and methods

This report is based on publicly available information in reports, press releases, web texts and media from the companies and authorities concerned, as listed below. The analysis is based on the plans and ambitions announced in the published material. Data was gathered in January to March 2024, and thus reflects the state of the public information at that time.

During the same period, supplementary and clarifying interviews were conducted with companies, authorities and municipalities. No internal or non-public information has been used in the report.

Estimates and calculation methods

The socio-economic calculations in Chapter 3 have been carried out according to the principles and methods described below. All calculations refer to 2024 monetary values. All calculations describe the added value created by the industrial investments covered in the report. This is a gross impact: it does not take into account alternative costs, for example in the form of labour that could have been used in other parts of the economy, that investments could have been made elsewhere instead, and that a certain proportion of the value described is thus redistributed rather than a pure net gain.

GDP potential

The reported financial plans of the companies concerned form the basis for the calculation, with the companies' turnover, operating profit, taxes and labour costs then modelled for the target year 2030. Unless otherwise stated in the companies' plans, it is assumed that the profit share and personnel cost share in 2030 will remain unchanged compared with the current situation, as well as the share of personnel costs in Sweden (for companies with costs in and outside the country). Operating profit, taxes and labour costs constitute the value added or GDP contribution of the business. The direct GDP potential of the industrial investments is thus the difference between the companies' current value added and the estimated value added if the plans are realised.

The direct GDP potential has a multiplier of 2–4 applied, representing the additional value added from suppliers and subcontractors, local services, and spent and reinvested value added, arising from increased industrial activity. The magnitude of the multiplier effect is uncertain and varies across industries and geographies, as well as depending on the focus of new investments and the composition of value chains. The 2–4x range was chosen based on typical multipliers in the mining and metals industry and a Swedish value chain; the size of the range reflects the uncertainty that exists.

The calculation is simplified and aims to show the order of magnitude of the potential: the actual GDP impact, even if the industrial investments are implemented as planned, may be larger or smaller.

Export potential
The export potential presented here is based on the companies' reported production plans and reported or deduced sales increases. Based on interviews with the companies, almost 100% of the increase in production is assumed to be exported.

Tax revenue
As in the calculations above, estimated tax revenue is based on the companies' reported financial plans, which inform assumptions about turnover, operating profit and personnel costs. The companies' cost structure is assumed to remain unchanged in terms of profit and proportion of personnel costs. Income taxes are based on the overall increase in the labour force (see below for methodology), where wages are assumed to be at the Swedish average income level (around SEK 38,000 per month in 2023) and 20% of employees are expected to pay state income tax, in line with the national average. The additional workers required for the companies' plans are assumed to be resident in the municipalities where the production takes place, with the applicable tax rates. Tax rates are assumed to remain unchanged throughout. In addition to the corporate and income taxes expected to be generated as described above, the VAT levy assumed to result from increased income and consumption is also estimated.

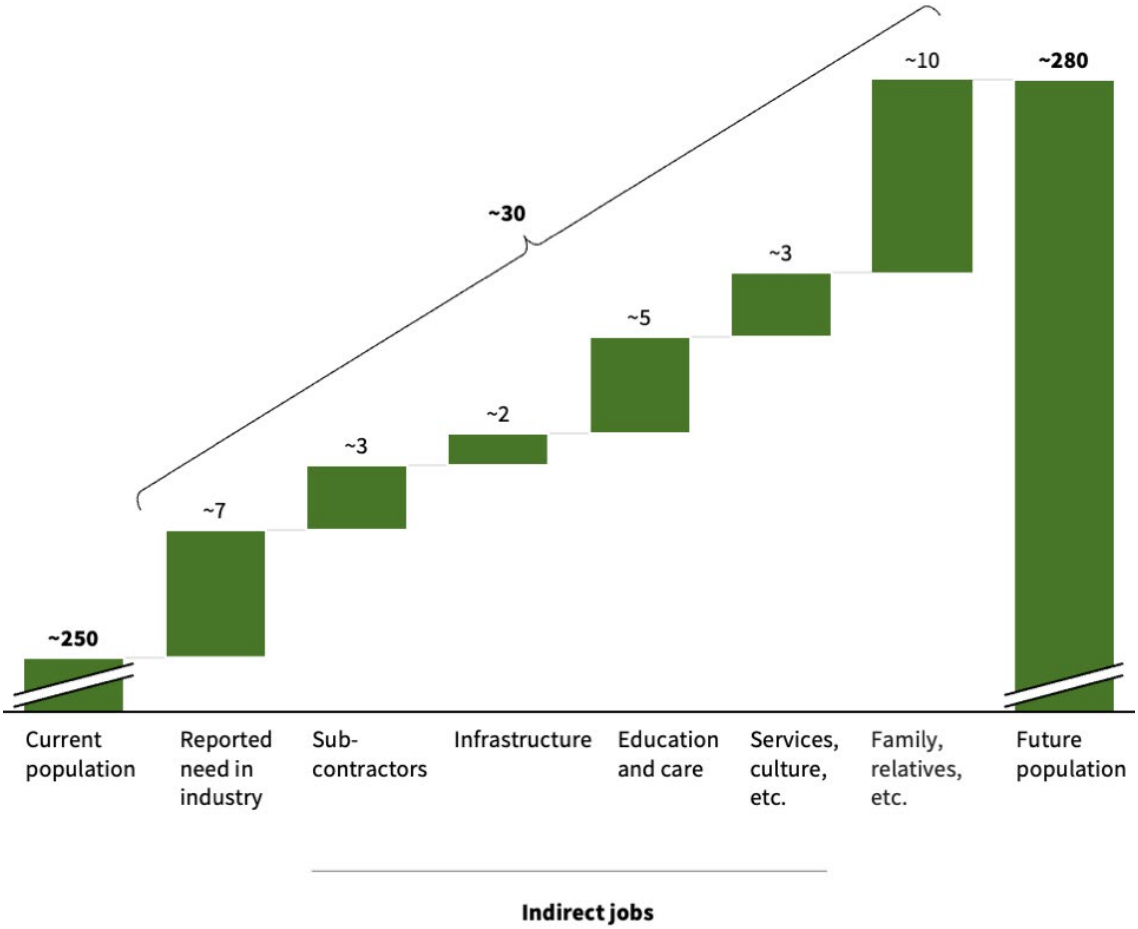
The multiplier effects for corporate profits are applied at 2–4x, based on the same principles highlighted above under GDP potential.

Jobs and population
The number of new jobs is based on the data published by the companies concerned. In addition, there will be indirect jobs with subcontractors, infrastructure companies, local services and the public sector. The additional workers required for the companies' plans are assumed to be incomers, based on an already low unemployment rate in the region, combined with a large number of impending retirements.[73] They are assumed to settle in the municipalities where the production takes place. In addition to migrant labour, there will be accompanying family members; over the time period studied for the report up to 2030, this effect is expected to be relatively limited. The same ratios between industrial jobs, other jobs and accompanying family members have been applied as those in government analyst Peter Larsson's report on major business establishments and expansions in Norrbotten and Västerbotten67, as shown in the figure below.

HOUSING & SOCIETY: New jobs and inward migration could eventually lead to ~30,000 new residents

Illustrative example of possible population growth in Norrbotten

Population growth in Norrbotten to 2030
Thousand inhabitants



Climate benefit

Climate benefit is a measure of hypothetical emissions avoided by manufacturing a product with low carbon emissions in Sweden instead of using conventional methods with higher emissions elsewhere in the world. The difference between emissions from planned production and the global average, per product and type of production, is based on emission factors from the report "Klimatnyttan av Svensk export" (2021)[74]; these are scaled up proportionally with the companies' planned and reported production volumes.

Need for enabling investments

The investment need is based on the demand for electricity, labour and transport as publicly communicated by the companies. The needs described here relate exclusively to the impacts of the green industrial projects, and should not be interpreted as forecasts or assessments of total expansion needs; the effects of other societal changes, such as the expanded activities of the Swedish Armed Forces, Kiruna's town relocation or retirements are not taken into account.

Electricity generation and networks

The analysis is based on the increased electricity consumption reported by the companies themselves and is compared with published plans for new electricity production in Norrbotten County, consisting solely of wind power, and does not take into account reinvestment needs or the decommissioning of power production when assessing the development of the energy balance between 2022 and 2030.

The calculation of the cost of maintaining the 2022 energy balance is based on average investment costs per TWh of expected annual production for new wind power in Sweden during the years 2017–2024, using statistics from Svensk Vindenergi.[75] This situation should be seen as an example calculation to illustrate the scale of the growing electricity demand. In reality, it may not be either possible or desirable to maintain 2022's energy balance in the county.

The need for electricity network expansion is based on previously published calculations,[64] supplemented by interviews.

Housing and social infrastructure

The need for housing is based on the projected population growth described in the *jobs and population* section above. The estimated cost of newbuild developments draws on figures from Statistics Sweden and on current and region-specific data on the distribution between single-family houses and apartment buildings, average area, construction cost per square metre and number of residents per dwelling for each type of housing, with construction costs adjusted for inflation.

In addition, there is a need for public infrastructure in the form of schools, health care, social care, local roads, water and waste and other public services linked to a growing population. The extent of the need is an estimate based on maintained service levels per inhabitant as well as public comparisons of the average number of schools, health and care facilities per inhabitant in Sweden. The investment costs for health, education and care factor in average space requirements and construction costs per square metre for each activity. The need for investment in other public infrastructure has been estimated at a flat rate per capita, based on interviews with property companies and municipalities.

Transport

The need for investment in transport infrastructure has been taken from the Swedish Transport Administration's assessments in the National Plan for Transport Infrastructure.[38] Assessment of the possibility of accelerating work on the Malmbanan line involved weighing up the Swedish Transport Administration's own assessments of the potential to bring forward the various sub-measures planned along the route.[71]

Noter och källor

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5 Spain: Spain's National Recovery and Resilience Plan is the second largest plan funded by NextGenerationEU and allocates EUR 163 billion to the green transition

European Parliament: 'Spain's National Recovery and Resilience Plan: Latest state of play' briefing, Mileusnic Marin, October 2023, https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698878

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7 Spain: Spain's National Recovery and Resilience Plan is the second largest plan funded by NextGenerationEU and allocates EUR 163 billion to the green transition

European Parliament: 'Spain's National Recovery and Resilience Plan: Latest state of play' briefing, Mileusnic Marin, October 2023, https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2022)698878

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9 Energiforsk: 'Visualisering av Sveriges Framtida Elanvändning och Effektbehov', Report 2023:913, ISBN 978 91 7673-913-6, January 2023

10 Elbruk.se: Electricity prices 2020–2023, statistics reportedly taken from Nord Pool, retrieved 4 April 2024, https://www.elbruk.se/elpris-historik-2023

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Eurostat: 'Electricity prices for non-household consumers – bi-annual data (from 2007 onwards) [nrg_pc_205]', filtered for consumption over 150,000 MWh per year, last updated 11:00 on 4 April 2024, https://ec.europa.eu/eurostat/databrowser/view/nrg_pc_205__custom_10702678/default/table?lang=en

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25 Talga's own feasibility study indicates an investment need of about SEK 6 billion for the mine and plant, including contingency reserves

Talga Group: Detailed Feasibility Study, ASX release, 1 July 2021, https://talgagroup.eu-central-1.linodeobjects.com/app/uploads/imports/asx-announcements/47146b39-9c1e-42ef-830e-15ef895e5b63/RobustDFSPavesWayForTalgaBatteryAnodeProject.pdf

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Appendix: Selected facts about industrial investments

H2 Green Steel

Integrated plant for fossil-free steel from 2025

Completed Not completed

Description

H2 Green Steel is a Swedish industrial start-up for the production of near fossil-free steel founded by Harald Mix (Vargas Holding) and others.

The company is planning a plant in Norra Svartbyn in Boden for near fossil-free hydrogen-based iron and steel production (H-DRI). The plant is expected to comprise three integrated elements: 1) hydrogen production, 2) sponge iron production, and 3) steel production. The plant is expected to be commissioned in two phases: the first phase will start production in 2025/2026 and the second around 2030.

Reported impacts

Jobs	• 1,500 jobs in factory in phase 1 • 2,000 jobs in factory in phase 2 • 4,500–5,000 temporary jobs during the construction phase
Economics	• SEK 130 billion in contracts secured so far (equating to at least 1.5 million tonnes of steel)
CO_2 reduction	• Up to 95% reduction in CO_2 emissions

Enabling factor		Status
Funding	• Secured SEK 75 billion to cover phase 1	●
	• Funding for phase 2 is not completed	●
Electricity supply	• Power allocation for phase 1 (to cover 10 TWh/year)	●
	• In queue for power allocation for phase 2 (to cover additional 3–7 TWh)	●
	• Fossil-free electricity contracts (4.3 of 13–17 TWh)[1]	●
Environmental permit	• Permit in place for construction and operation (with conditions)	●
Planning permission	• Planning permission in place for factory site	●
Transport infrastructure	• Double track on Luleå–Boden stretch of Malmbanan line needed for phase 2, otherwise limited capacity could be a bottleneck	●
	• Port of Luleå: Victoriahamnen needs to be completed for phase 1, all-weather terminal and capacity increase of the shipping lane are important for phase 2	●
Housing	• Both H2GS and the municipality highlight the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	●

1. Long-term electricity purchase agreements with Fortum, 2.3 TWh/year, and Statkraft, 2 TWh/year

Source: Company reports, press releases and other public communication material

LKAB: Fossil-free LKAB

Switch to fossil-free direct-reduced sponge iron

● Completed ● Not completed

Description

Through Hybrit (a joint venture with SSAB and Vattenfall), LKAB has developed technology for fossil-free direct-reduced sponge iron. LKAB intends to employ the technology in a demonstration plant in Malmberget in 2026, and then gradually ramp up production capacity through more plants in Malmberget and Kiruna, with an eventual switch entirely from iron ore pellets to sponge iron.

This transition is taking place alongside the development of a new mining standard based on digitalisation, automation, electrification and new ways of working, enabling a fossil-free value chain.

Reported impacts

Jobs	• 150–200 jobs in DR plant[1] # 1 • No information about the other plants • 2,000–3,000 jobs over 20 years in renovation and construction
Economics	• 2x current turnover could be achieved by 2045 through growth and added value
CO_2 reduction	• 40–50 million tonnes of CO_2 globally • 2045, all products & processes CO_2-free

Enabling factor		Status
Funding	• SEK 150–400 billion over 15–20 years (cash flow and external loans incl. corporate bonds)	●
	• SEK 3.1 billion in support for demo plant (#1)[2]	
Electricity supply	• 4–5 TWh/year, received prior notification of power allocation for DR plant #1	●
	• 70 TWh/year may be needed by 2050, increasing gradually and requiring more power	●
	• Cooperation with Statkraft on future renewable electricity generation, early stage	●
Environmental permit	• County Administrative Board has requested additional info in application for DR plant #1, the appatite plant and existing activities (Dec 23)	●
Transport infrastructure	• Capacity increases on Luleå–Riksgränsen stretch of Malmbanan line for increased exports via the ports in Narvik and Luleå and for further processing by SSAB in Luleå	●
	• Double track on Luleå- Boden stretch of Malmbanan line needed as own and H2GS volumes increase sharply along the route	●
	• Capacity measures (dredging, quay etc.) important to enable increased exports	●
Housing	• Both permanent housing and construction accommodation are expected to be needed in Gällivare and Kiruna for 2,000+ employees in construction and operations, and for the likely accompanying population growth	●

1. DR plant: Direct reduction plant
2. Support from the Swedish Energy Agency through the 'Industriklivet' support programme'

Source: Company reports, press releases and other public communication material

LKAB: ReeMap

Circular industrial park

Completed Not completed

2027

Circular industrial park in operation

Description

The ReeMAP project is run by LKAB and involves establishing a circular industrial park to recycle mining waste (tailings) from its iron ore production.

The company intends to extract phosphorus and rare earth elements, which are important for the economy and for reducing the EU's dependence on imports. The industrial park will also produce gypsum and fluorine products, among others.

Reported impacts

Jobs	• 150–200 jobs in DR plant #1, other phases unknown • 2,000–3,000 jobs over 20 years in renovation and construction
Economics	• No information
CO_2 reduction	• No information

Enabling factor		Status
Funding	• SEK 10 billion	Completed
	• No information on specific funding arrangements for ReeMap	Completed
Electricity supply	• No information on the status of any power allocation, but expected to need equivalent of 2.5 TWh electricity	Not completed
Environmental permit	• Not yet applied for. The County Administrative Board and the Swedish Environmental Protection Agency have commented on LKAB's upcoming licence application	Not completed
Transport infrastructure	• Capacity increases on Luleå–Riksgränsen stretch of Malmbanan line are necessary to create space for the transport of mining waste on an already strained route	Not completed
	• Double track on Luleå– Boden stretch of Malmbanan line needed as own and H2GS volumes increase sharply along the route	Not completed
	• Capacity measures (dredging, quay, transport infrastructure connecting with the circular industrial park) are important to enable planned exports	Not completed
Housing	• The municipality highlights the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	Not completed

Source: Company reports, press releases and other public communication material

SSAB

Integrated electric steelworks and rolling mill

Completed Not completed

Description

SSAB's steel production in Luleå will be converted from a blast furnace, coking plant and existing steelworks into a new integrated electric steelworks with an electric arc furnace, rolling mill and finishing mill. This entails a shift in the value chain, with LKAB taking over the reduction step and delivering direct-reduced sponge iron to SSAB, which will then combine it with scrap iron to produce fossil-free steel.

Reported impacts

Jobs	• 150 jobs in the new electric steel plant • Hundreds of jobs in the construction phase
Economics	• No information
CO_2 reduction	• 2.8 million tonnes of CO_2 annually, own emissions

Enabling factor		Status
Funding	• EUR 4.5 billion (approx. SEK 50 billion) in total investments in Luleå, including a contingency framework	●
Electricity supply	• ~3 TWh/year, received prior notification of power allocation	●
Environmental permit	• Application for environmental permit submitted (Nov 23)	●
Transport infrastructure	• Capacity increases on Luleå–Riksgränsen stretch of Malmbanan line are necessary to handle increased transport volumes from LKAB and others, on which SSAB depends	●
	• Double track on Luleå–Boden stretch of Malmbanan line needed as LKAB and H2GS's volumes increase along the route	●
	• Capacity measures (dredging, quay etc.) important in continuing to enable increased exports as demand for the port grows	●
Housing	• The municipality highlights the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	●

1. The exact year has not been announced, but SSAB has reported that the transition to fossil-free steel production will be completed around 2030

Source: Company reports, press releases and other public communication material

Power2Earth

Green Wolverine Project (fossil-free fertiliser)

Completed Not completed

Description

Grupo Fertiberia is an established Spanish company that produces fertilisers and industrial chemicals in several European countries.

The company is planning a new factory to produce 0.5 million tonnes of fossil-free fertiliser annually at Luleå Industrial Park. The factory will be supplied with hydrogen via a 38-kilometre underground pipeline from a new facility in Boden.

Reported impacts

Jobs	• 500 jobs from production start 2027 • 2,000 temporary jobs during the construction phase
Economics	• No information
CO_2 reduction	• Potential to reduce emissions by ~1.6 million tons CO_2 equivalents.

Enabling factor		Status
Funding	• SEK 15–20 billion in announced investments	●
Electricity supply	• No power allocation	●
Environmental permit	• Environmental process not started	●
Transport infrastructure	• Port of Luleå, measures are important to secure export capacity as several green initiatives lay claim to the port's capacity	●
Other	• No communication around additional permits related to the pipeline between Letsi and Luleå	●
Housing	• The municipality highlights the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	●

Source: Company reports, press releases and other public communication material

Talga

Factory for sustainable battery anodes for lithium-ion batteries

Completed Not completed

Description

Founded in 2009, Talga Group is a vertically integrated Australian materials company with its own mining and materials engineering, and operations in Sweden, Germany, Japan and Australia.

The company plans to mine graphite at Nunasvaara Södra, outside Vittangi in Kiruna municipality. The graphite will be used to produce 19,500 tonnes per year of sustainable battery anodes in a factory being built in Luleå Industrial Park. The anode material will be sold on for the production of electronic components and lithium-ion batteries for electric cars.

Reported impacts

Jobs	• Around 60 direct jobs in the mine and about 150 direct jobs in the factory in Luleå • Hundreds of jobs during construction
Economics	• No information
CO_2 reduction	• Potentially 92% lower climate footprint than existing anode materials imported into Europe

Enabling factor		Status
Funding	• Approx. SEK 5 billion in announced investments	●
	• Received USD 27 million in the first investment round and has been granted EUR 150 million from the European Investment Bank	●
	• No information on further needs	●
Electricity supply	• 40+8 MW (may correspond to approx. 0.4 TWh/year)1	●
	• Vattenfall Eldistribution has applied for a licence to upgrade 150 kV lines to Hertsöfältet	●
Environmental permit	• Environmental permit in place for graphite mining	●
	• Environmental licence in place for factory in Luleå	●
Transport infrastructure	• Capacity increases on Luleå–Riksgränsen stretch of Malmbanan line are necessary to ensure capacity on the tracks between Talga's mine and factory as LKAB and H2GS increase their volumes	●
	• Double-tracked Luleå–Boden stretch of Malmbanan would provide a link between Talga's mine and factory, and needs to be upgraded for that reason	●
	• Talga plans to export anode material and is thus dependent on capacity measures being implemented at the Port of Luleå	●
Housing	• Luleå and Kiruna municipalities both highlight the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	●

1. If 48 MW are used for around 8,000 hours per year. Reported distribution is 40 MW to the factory in Luleå and 8 MW to the mine in Vittangi.

Source: Company reports, press releases and other public communication material

Copperstone

Reopening the Viscaria mine for sustainable copper mining

Completed Not completed

Description

Copperstone Resources plans to reopen the Viscaria mine in Kiruna following a sharp rise in current and forecast demand for copper due to electrification and the green transition. The mine has been closed since the turn of the millennium.

With an estimated annual output of 30,000 tonnes, Viscaria is expected to become Sweden's second largest producer of copper and play a significant role in the European market.

Reported impacts

Jobs	• 250 direct jobs when the mine comes on stream • 500 temporary jobs during the construction phase
Economics	• Estimated SEK 850 million net profit per year
CO_2 reduction	• Potential to be one of the 5% most climate-efficient mines in the world

Enabling factor		Status
Funding	• SEK 4.5–5 billion capex requirement for start-up	●
	• SEK 1 billion invested in project so far	●
	• 60% target for loan financing	●
Electricity supply	• 70 MW (may correspond to approx. 0.5 TWh/year)[2]	●
	• Note: operation should be able to start even before full power supply is in place[3]	●
Environmental permit	• Process ongoing, main hearing expected in February 2024	●
Transport infrastructure	• Capacity increases on Luleå–Riksgränsen stretch of Malmbanan line are needed to ensure capacity on the tracks between the mine and the port as LKAB and H2GS increase their volumes	●
	• Double-tracked Luleå–Boden stretch of Malmbanan would provide a link between the mine and the Port of Luleå and needs to be upgraded for that reason	●
	• Copperstone is expected to export via the Port of Luleå, among other routes, and is thus dependent on the capacity measures being implemented	●
Housing	• The municipality highlights the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	●

1. Customer agreements not yet negotiated and various logistics options are being considered (Application for environmental permit, TB Annex A)
2. If 70 MW are utilised for around 8,000 hours per year
3. A connection agreement is to be concluded with Vattenfall, which in turn has submitted a licence application to Ei for the relocation of high-voltage lines

Source: Company reports, press releases and other public communication material

Uniper

BotnialänkenH2 (electrofuels for shipping)

Completed Not completed

2027

Start of production

Description
BotnialänkenH2 is an initiative to establish a regional hydrogen hub in Luleå to produce 12,000 tonnes of fossil-free hydrogen using wind power, with the hydrogen then used in the regional process industry, converted into electrofuel for shipping, or exported.[1]
The project is a joint venture between Uniper, the Port of Luleå, Luleå Energi, ABB and ESL Shipping, with Uniper responsible for construction alongside Hybrit's hydrogen storage pilot in the south-west of Svartön.

Reported impacts	
Jobs	• 150 direct jobs • No information on temporary jobs during construction phase
Economics	• No information
CO_2 reduction	• 80,000–150,000 tonnes of CO_2 annually, depending on how the hydrogen is used • Volume 12,000 tonnes of fossil-free hydrogen

Enabling factor		Status
Funding	• SEK 2 billion capex requirement (Uniper is assumed to have the capital required) • No information regarding funding from support programmes	●
Electricity supply	• In queue for power allocation, needs 150 MW initially and 250 MW later (approx. 1.2–2 TWh/year)	●
Environmental permit	• Environmental process not started	●
Transport infrastructure	• Port of Luleå, capacity measures necessary for ship traffic to reach sufficient volumes to justify the size of the facility	●
Housing	• The municipality highlights the housing situation as a potential bottleneck, since construction is not keeping pace with expected demand	●

1. Proportion of processing not yet determined

Source: Company reports, press releases and other public communication material

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