Trøndelag fylkeskommune
Tröndelagen fylhkentjïelte

REGIONAL PLAN FOR ENERGY TRANSITION

Adopted by the county council on 12 June 2025

BILDET ER KI-GENERERT

Contents

Preface

Access to energy and a well-functioning energy system are prerequisites for value creation and welfare in Trøndelag. The energy sector faces a well-known trilemma between the conflicting goals of affordable energy, secure energy supply and energy production that does not impact on the environment and future generations.

Trøndelag is well positioned to develop the energy and industrial solutions of the future, through access to renewable resources, strong research environments and adaptable industries. Trøndelag aims to be a driving force for energy transition and clean industry, while the ambition of reduced greenhouse gas emissions towards 2050 remains firm. The transition to new energy sources will take place in a way that strengthens the development of industrial value creation throughout the county. We will achieve our climate targets by cooperation with all relevant actors in the region. Carbon capture and storage (CCS) is one of several crucial technologies and value chains for reducing emissions in existing industry and facilitating new growth. Phasing out fossil energy must be prioritised when developing new value chains and solutions for industry.

Energy transition in Trøndelag means shifting from fossil to renewable energy. This involves prioritising measures to reduce energy waste and facilitate investment in infrastructure to support a renewable energy system. Moreover, it means increasing renewable energy generation capacity. in Trøndelag. During this energy transition, we also need to consider our stewardship responsibility, including for Southern Sami culture.

The Trøndelag County Authority and the Trøndelag municipalities have different roles in the energy system and access to a wide range of instruments. As a developer, owner and operator of public infrastructure, we will increase our ability to save, produce, store and share energy. Through our public transport service, we will contribute to market development in collaboration with the state and other counties. We will also offer educational pathways supporting clean transition.

The current regional planning strategy for Trøndelag has three priority areas that address different challenges in the energy system, in both the short and long term:

1. Trøndelag takes responsibility for climate and nature-related challenges
2. Good societal preparedness in a safe Trøndelag
3. Trøndelag has sufficient labour and the right expertise to meet a changing working life

We will develop an energy policy in collaboration with residents, private sector, State and municipalities. The national policy concerning electrification of the Norwegian Continental Shelf could create major challenges for land-based industry in Trøndelag. The State's desire to develop wind power and industry faces local resistance due to concerns over the value of untouched nature, the loss of biodiversity and indigenous rights. In the cooperation agreement between the Sami Parliament and the County Council, the parties agree to safeguard the natural foundation for Sami culture, business practices and social life in the county through active and conscious planning at the county level.

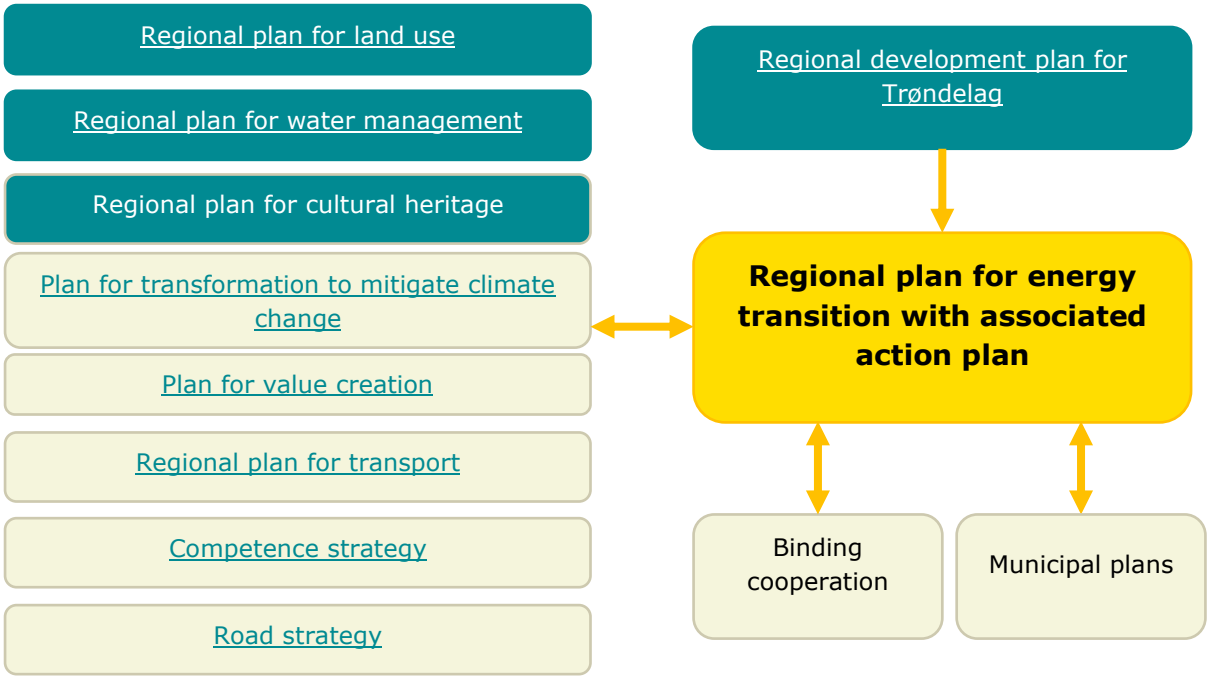
Trøndelag will build on its strengths through active planning at the county level. The aim is to create a region where climate ambitions and industrial optimism are closely linked and where clean, new solutions create jobs, export opportunities and optimism for the future.

County Mayor
Tomas Iver Hallem

County Director
Carl-Jakob Midttun

The plan's placement in the regional planning system

Regional policy is stipulated in regional plans with associated action plans to follow up specific measures. The regional plan for energy transition must interact with other relevant plans. This applies to plans complied pursuant to the Planning and Building Act (shown in dark boxes) and other legislation (shown in light boxes).



Relevant guidelines

National policies and official reports

- Meld. St. 16 (2024–2025) The Norwegian Industry – Competitiveness for a new time
- Meld. St. 25 (2024–2025) Climate Report 2035
- National expectations regarding regional and municipal planning 2023–2027
- Meld. St. 36 (2020–2021) Putting energy to work
- Meld. St. 11 (2021–2022) Supplementary white paper on energy policy
- Meld. St. 35 (2023–2024) Norsk handlingsplan for naturmangfold (Norwegian action plan for biodiversity)
- Handlingsplan for energieffektivisering i alle deler av norsk økonomi (Action plan for energy efficiency in all sectors of the Norwegian economy)
- National planning guidelines for climate and energy
- National digitalisation strategy 2024-2030
- Official Norwegian Reports: Nett i tide (Grid on time), Mer av alt – raskere (More of everything faster), Strømprisutvalget (the Electric power price committee) and Nuclear powerutvalget (the Nuclear power committee)

The energy system in Trøndelag

For several decades, we have had access to abundant and affordable energy in Norway. However, electrification of the offshore platforms, transport sector and industry mean we are moving into a situation of scarcity. Consumer demand in Trøndelag and Norway is growing faster than expansion of production capacity and the grid. Most projections show that this will lead to higher electricity prices up to 2030, before prices drop toward 2040 owing to the development of renewable energy. The addition of more intermittent power production to the energy system is also likely to lead to greater price fluctuations throughout the day and year than previously (NVE, 2023). The energy transition will entail costs while also creating opportunities to generate new revenue, making the distribution of these costs and revenue an important political issue.

Figure 1 illustrates the energy system in Trøndelag. The main electricity consumers are industry, commercial buildings and households. Of the county's total energy consumption of 23 TWh in 2022, more than half came from fossil energy sources used in industry, primary industries and transport. Energy consumption from coal is attributed to the smelting industry's use of coal as a reducing agent. District heating and bioenergy are mainly used to heat households and commercial buildings.

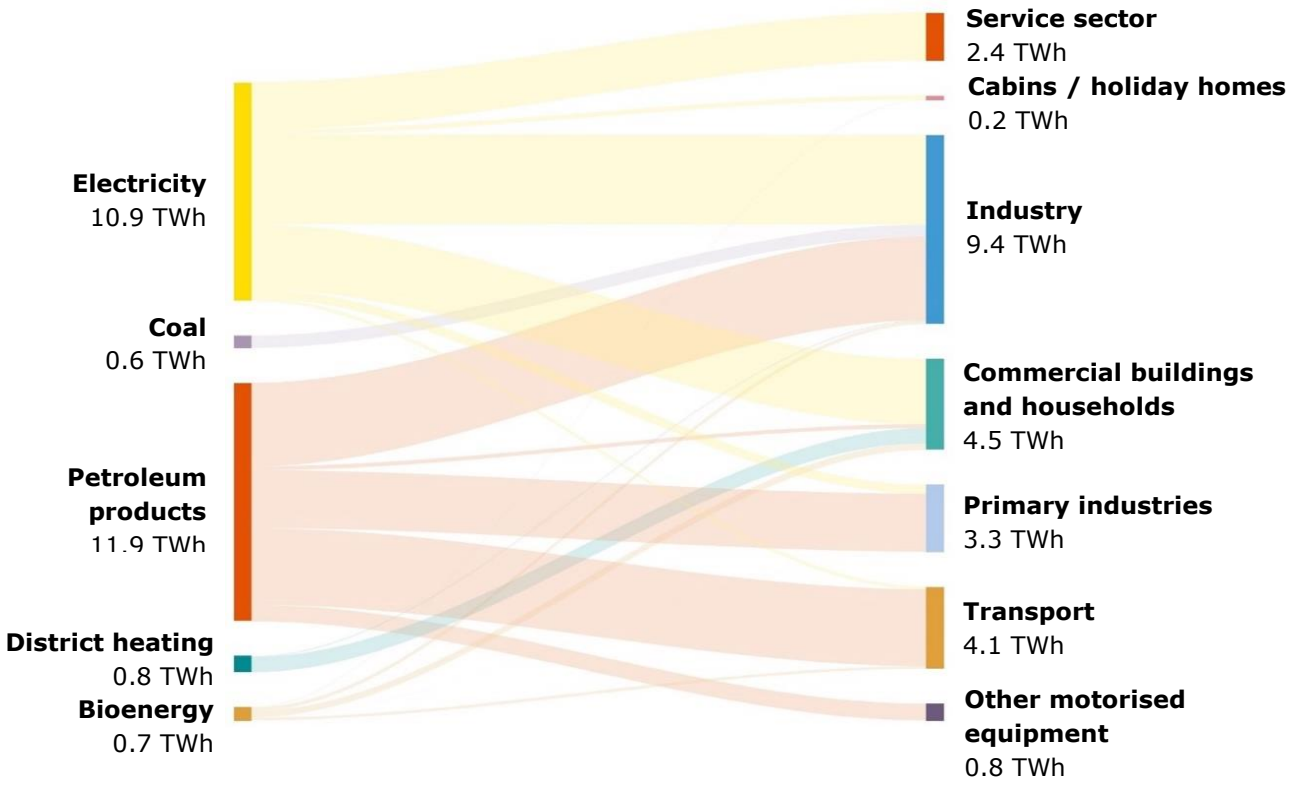


Figure 1: This figure shows the energy balance in Trøndelag. The left axis shows the energy sources and the right axis shows where the energy is consumed (figures from 2022, Energidashboard).

The Norwegian grid is divided into five bidding zones. Most of Trøndelag is in zone NO3 together with Møre og Romsdal county and small parts of Vestland and Innlandet counties. However, Røros municipality is in zone NO2 while the northern municipalities of Lierne, Røyrvik, Namsskogan and parts of Grong are in zone NO4. Consequently, these municipalities experience different electricity prices than the rest of Trøndelag.

Statnett is responsible for the national transmission. The transmission grid gives Trøndelag access to hydropower and wind power from Nordland and Sweden. There are bottlenecks in the transmission grid to the south, and projects with large power requirements such as electrification of the continental shelf off the Trøndelag coast, hydrogen production and other new industries have made it clear that the grid capacity is insufficient. Statnett has indicated the need for improved grid capacity between Trøndelag and Sweden (Statnett 2023). Insufficient grid capacity is also major barrier to the establishment of new power production because electricity often becomes locked in when transmission capacity is limited. A review by the Office of the Auditor General of Norway found that the Ministry of Energy has not provided clear governance signals in relation to developing the transmission grid to achieve the objective of phasing out fossil energy.

Tensio has the main responsibility for the regional and distribution grid in Trøndelag. Tensio is in the process of carrying out area studies for energy development in Trøndelag. These area studies will replace the previous regional power system studies and form an important part of the work to ensure a reliable and efficient power supply for residents and businesses in Trøndelag. Nettselskapet AS holds the area concession for the south-western part of Trøndelag and parts of Fosen, while Nettselskapet AS, Mellom and S-Nett hold the area concession in the area near the county border between Trøndelag and Møre og Romsdal.

Energy, preparedness and security of supply

The current geopolitical situation is extremely serious and is expected to persist during our generation. Trøndelag is exposed to risk due to its 'geographically strategic location with a long coastline, proximity to Sweden, and the presence of defence installations and national emergency resources. As part of critical national infrastructure, energy infrastructure is vulnerable to hybrid threats. Significant threats include cyber-attacks targeting information and operating systems and sabotage of critical infrastructure. The consequences of such attacks on energy supply could be severe, affecting large parts of the community.

One of Norway's most important defence installations is situated on the Fosen peninsula in Trøndelag. This necessitates special requirements for energy supply, robustness and preparedness. Energy planning at municipal and the wider regional level must place greater emphasis on security of electricity supply and prioritise critical infrastructure. Consequently, it is of the utmost importance that the capacity of the regional grid is strengthened. Cooperation with Ørland Main Air Station, which is developing its own plans for energy transition, can complement and strengthen local and regional plans.

Resilience: the energy industry has little experience in handling physical attacks from actors with the capacity and knowledge to cause serious damage to critical infrastructure. Therefore, resisting such attacks cannot be left to the energy sector alone. Cooperation with governmental agencies, such as the Police and the Armed Forces with the support of state intelligence agencies, is imperative.

Municipalities have a responsibility to maintain essential public service in the event of power outages, while the county authority is responsible for coordinating the evacuation of residents. Extreme weather, with more frequent storms and heavy precipitation will create the need for enhanced preparedness across all administrative levels.

Using a mix of energy sources, such as hydropower, wind, solar and district or local heating, increases redundancy and security of electricity supply. Using local energy for heating contributes

to the decentralisation of energy supply and can make Trøndelag less vulnerable to power outages. Local power production and district energy can also reduce vulnerability to capacity constraints in the national and regional power grids. The design of the energy system of the future must ensure safety and civil preparedness, while adopting zero-emission technology.

Where will we be in 2050?

This plan is based on a synthesis of several projections of energy demand presented in Figure 2. Assumptions for the years up to 2030 are that the transport sector will require 1.2 TWh for electrification, while the oil and gas platforms in the Haltenbanken area will require 2.1 TWh. Electrification of industry will increase consumption by 0.1 TWh, while improvements in energy efficiency could reduce demand by 0.5 TWh. Systematic efforts to enhance energy efficiency could further reduce demand by 0.9 TWh by 2050. In the period up to 2050, power demand is expected to increase in the industry sector by 0.8 TWh and in the construction sector by 0.6 TWh. However, a consumption reduction of 1.1 TWh is estimated within oil and gas by 2050 as fields in the Haltenbanken area are phased out. Phasing out fossil energy sources from transport will require a total of 3.2 TWh by 2050.

Consequently, power demand will increase by 4.6 TWh by 2050, based on the current consumption patterns and industrial structure. If clean transition in Trøndelag includes new industry and industrial development, the demand will be greater. Examples of new industry include hydrogen production, the battery industry, data centres, carbon capture and storage at major emission sites and biogas production. This will entail an additional 3.4 TWh in increased demand. Some of this increase is likely to come before 2030. For instance, power consumption from artificial intelligence (AI) could increase rapidly as data centres are relatively easy to establish compared to new value chains like hydrogen or carbon capture. Using this industrial growth scenario as a basis, the expected increase in demand is projected to be 8 TWh by 2050.

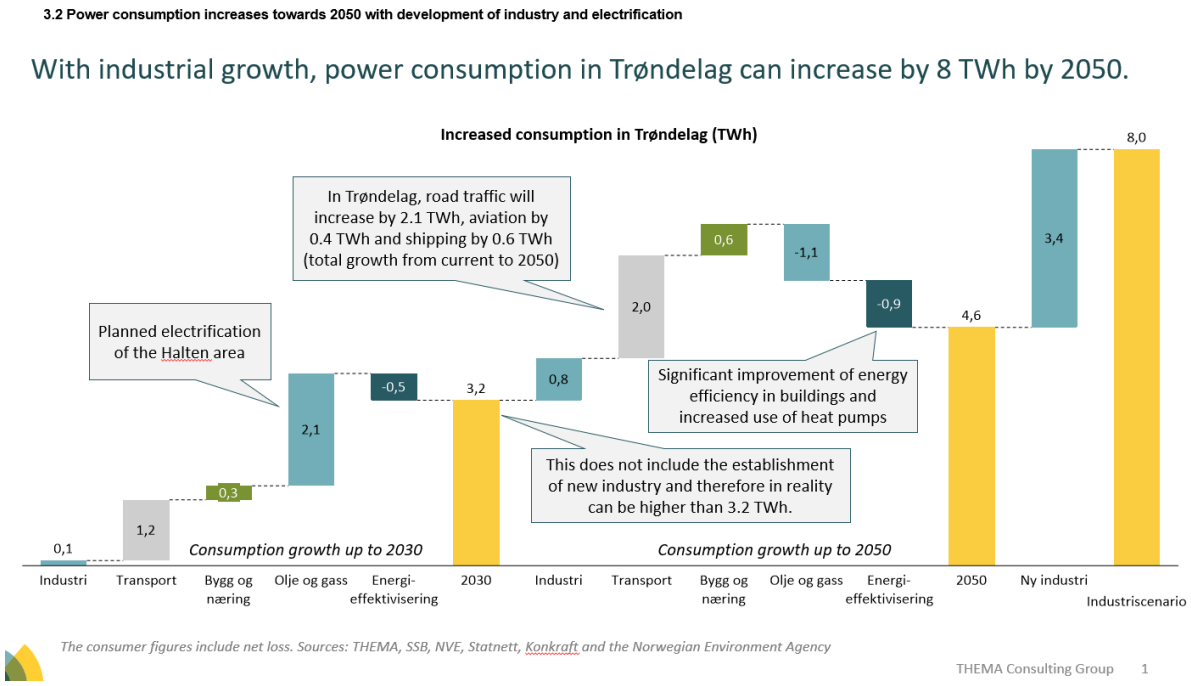


Figure 2: With industrial growth, Trøndelag power consumption can increase by 8 TWh by 2050 (Sources: THEMA, SSB, NVE, Statnett, KonKraft and the Norwegian Energy Agency).

There is a connection between climate transition and energy transition. The goal of achieving a low-emission society by 2050 will not be achieved without reducing the consumption from fossil energy sources to a minimum and using energy more efficiently in all sectors. Succeeding in an

energy transition will also necessitate safeguarding biodiversity and ensuring circular use of materials. In energy policy, one must weigh options between security of supply through diverse sources, price stability and human encroachment into nature. Assessments based on the Avoid-Shift-Improve framework are in accordance with the Climate Report presented by the government in the spring of 2025.

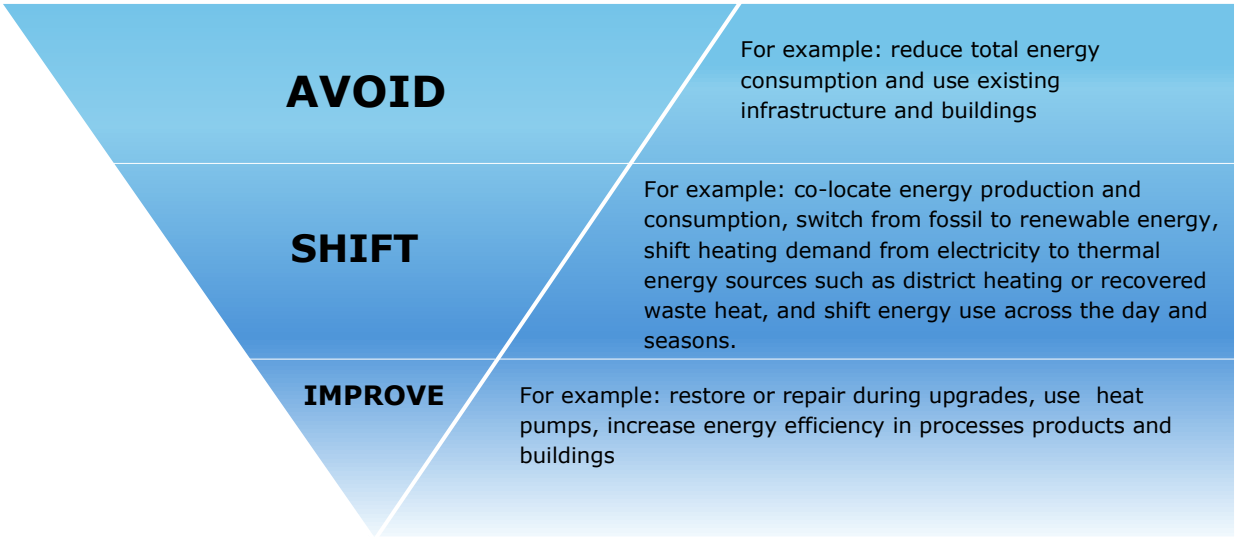


Figure 3: The avoid-shift-improve framework in the energy system based on White Paper 25 (2024–2025).

Future energy scenarios

How much energy is needed for transport, industry and households by 2050? What role will solar power, wind power or bioenergy play? What needs to happen to make society's energy consumption to be more efficient? The research communities at the Institute for Energy Technology (IFE) and the Norwegian University of Science and Technology (NTNU) have developed future scenarios modelled in the energy system model TIMES.

Who can contribute to energy transition?

This plan has been developed in collaboration with local, regional and national actors representing the breadth and depth of the energy system. Power companies and other market actors are competitors, the grid companies are publicly regulated monopolies, municipalities and the county authority have political leadership and nature conservation interests are represented by voluntary organisations. Government departments such as ministries and directorates influence all thematic areas. The region has important R&D communities, clusters and innovation companies that collaborate closely with the public support structures to strengthen the attainment of goals. Despite different perspectives from the various actors, they share the same view that a common understanding of challenges and strategic directions is more robust when developed together.

Owing to international and national policy and technological development, the Trøndelag energy system will undergo major changes between now and 2050. Utilisation of fossil sources, heat and electricity must be seen more in context at the local, regional and national levels, and requires cooperative relationships between various interests and actors. This regional plan outlines a shared framework for the energy transition throughout Trøndelag. Although Trøndelag County Authority does not have decision-making authority over power production or grid development, the county council as the democratically elected regional leadership, plays an important role in providing strategic direction and ensuring coordination across sectors.

Vision for energy transition in Trøndelag

Trøndelag – clean, innovative and inclusive		
Priority area	**Sub-goal**	**How do we achieve this?**
The role of the county authority and the municipalities	**Trøndelag county authority and the municipalities will ensure land use and energy supply that enables sustainable development, clean transition and increased value creation**	Planning authority and planning guidance covering land, energy, transport and water management Service providers for transport, construction and competence Public procurement Social development role
From fossil to renewable	**Phase out fossil energy and meet energy needs by using renewable and future-oriented solutions**	Electrification Decentralised production and consumption Carbon capture
Halt energy waste	**Reduce energy consumption for heating and in the transport sector by 0.5 TWh by 2030**	Use the entire toolbox Less electricity for heating Local energy areas Fair transition
Energy and power	**Trøndelag will have a sufficient and secure energy supply and produce 3 TWh more renewable energy by 2035**	Upgrade hydropower Wind power on already developed areas Roof surfaces for solar power Utilise local raw materials for bioenergy and heating resources Develop and understand the potential for offshore wind power More knowledge about nuclear power
Investments in infrastructure	**Trøndelag will increase flexibility in the use of the grid and heat and utilise solutions for storing and sharing energy across days and seasons by developing five local energy areas**	New grid and security of supply Energy coordination Prioritisation of connections

Energy policy dilemmas

The current energy system consists of heat, electricity and fossil fuels. Figure 4 shows the three sources of energy utilised through various energy production technologies, the actors in the energy system and parties with interests related to the energy system. This report from Trondheim Tech Port describes the energy technology system in Trondheim in more detail.

Figure 4 is also intended to illustrate how the development of energy technology is reliant on framework conditions from both national and international legislative authorities. Energy is a prerequisite for social development, and the way we harvest it and what we use it for is the result of negotiations between different societal interests. Thus, regional energy policy must navigate trade-offs between dilemmas. These opposing pairs are deliberately sharpened and will often be met with a "both-and" approach when different considerations need to be balanced.

Urban	↔	Rural
Predictability	↔	Adaptability
Established actors	↔	Startup environments
Public ownership	↔	Private investors
Industrial requirements	↔	Nature's intrinsic value
Market turnover	↔	Price signals through policy
Short-term profitability	↔	Socioeconomic costs
Centralised production and consumption	↔	Decentralised production and consumption

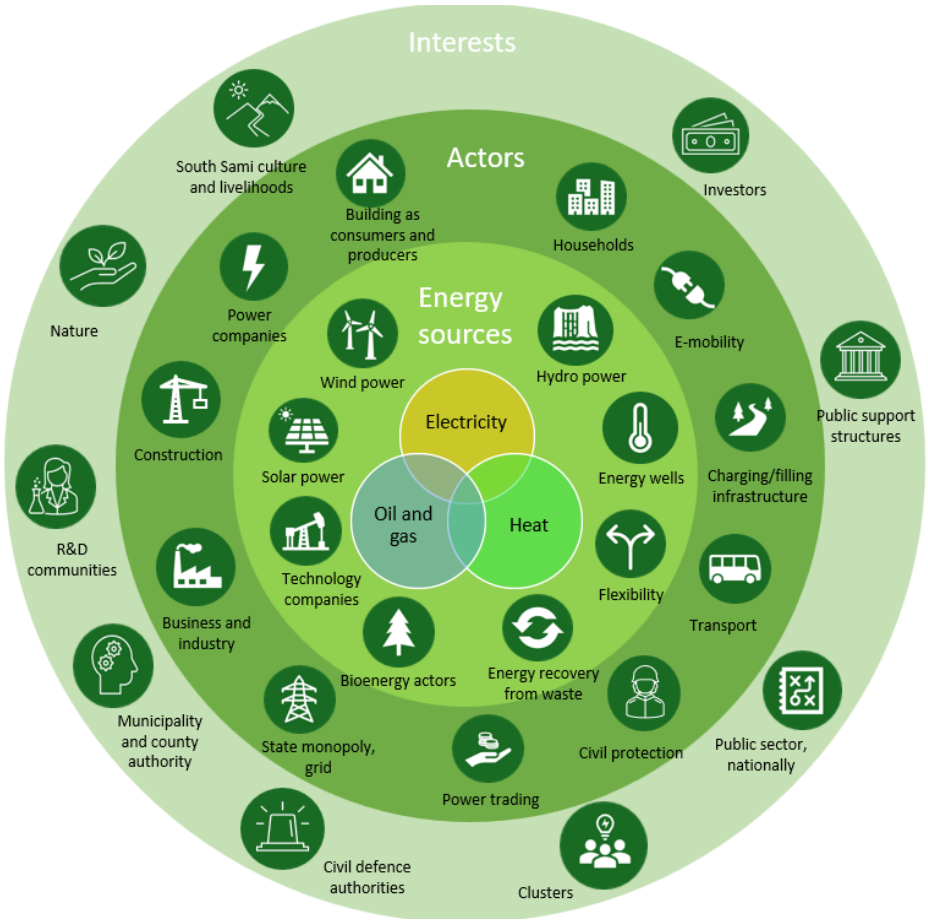


Figure 4: Illustrates the Trøndelag energy system with commercial and state actors who operate power and heating plants, distribute and trade, as well as consumers of power, heat and fuel.

1 The Trøndelag county authority and the municipalities as actors in the energy system

SUB-GOAL 1

The Trøndelag county authority and the municipalities will ensure land use and energy supply that enables sustainable development, clean transition and increased value creation

The municipalities in Trøndelag and Trøndelag County Authority play different roles within the energy system. Several municipalities have financial interests in power companies and grid companies and receive income from various direct and indirect taxes on power production. As democratically elected governing bodies, the municipal and county councils are expected to make choices about strategic direction for their local communities. The energy system enables clean transition to increase value creation, establish new sustainable businesses and more profitable jobs.

How do we achieve this?

Planning authority and planning guidance covering land, energy, transport and water management

The framework conditions for energy transition must be built on collaboration between national, regional and local policies. The Planning and Building Act is a good instrument. The municipalities must regulate land use for new power plants and grid infrastructure, plan and facilitate processes related to local energy utilisation, ambient heat, surplus heat, co-location of industry and commercial actors, and improving energy efficiency in buildings and in industry.

Coordination across municipal borders will become even more important when the energy system is decentralised. It will be necessary to implement overall planning of land use, energy and transport. This means having a regional perspective on the connection between energy infrastructure (grid and heat), commercial areas and the transport requirements of various actors and initiatives. It is necessary to coordinate and plan areas for the production and distribution of new energy carriers, such as hydrogen and ammonia within aquaculture and the fishing industry. Competence at the county authorities and municipalities should be further developed in collaboration with the knowledge environments in administration and academia to ensure that societal perspectives are incorporated into decision making.

The cooperation agreement between the Sami Parliament and the County Council states that the parties agree to safeguard the natural basis for Sami culture, commercial activity and community life in the county through active and conscious planning at the county level.

Service providers for transport, construction and competence

The county authority's responsibility for mobility and infrastructure directly affects the energy consumption of residents. When it comes to county roads, it will be essential to contribute to developing infrastructure that is in line with national low-emission targets in 2050. Up to 2030, the county authority is planning significant tenders covering the public transport service by bus and boat. Limited regional grid capacity will require new technologies and new collaborative constellations if the county is to meet the zero-emission targets. The Trøndelag County Authority is responsible for providing education at the upper secondary schools. Competence related to the use

and management of new energy carriers, such as batteries, hydrogen and electric aircraft engines, etc., is outlined in the Action Plan for the Competence Strategy.

Public procurement

Energy measures in municipal and county–owned buildings, equipment used for public transport and the operation and maintenance of municipal, county and national roads all offer great potential. Climate and environmental considerations are to be weighted at least 30% in the evaluation criteria in public procurements. When the county authority and municipalities demand energy-smart measures within the building and construction sector, this will create activity for local businesses and contribute to clean transition. Public building and construction sites account for a large market share, so requirements to adopt zero-emission technology are important for transformation of the construction industry. It is crucial that the market experiences that the public sector acts predictably and that requirements are set systematically and over time. In the energy system of the future, buildings will act as both producers and consumers of energy. Grønt Hjerte AS which translates as Green Heart is fully owned by the Trøndelag County Authority.

Grønt Hjerte:

The Trøndelag County Authority is working through Grønt Hjerte AS to establish joint energy solutions and develop energy infrastructure that connects buildings and energy-producing facilities. The target is 30 GWh annually by 2030, with 5 to 6 GWh coming from local solar power production and heat energy. Energy infrastructure with heat and electricity between buildings improves energy efficiency and reduces reliance on external energy sources. Grønn Hjerte collaborates with municipalities and property owners.

Social development role

Concession power is designed to compensate municipalities that have given up natural areas to produce hydropower. It is necessary to study how economic incentives can be designed to better facilitate a desired social and industrial development. This applies to the establishment of new industries as well as the upgrading of older hydropower plants. The county authority wishes to contribute to more holistic solutions that can serve Trøndelag's future energy requirements. Economic instruments such as concession power play an important role in this assessment.

As members of democratically elected governing bodies at the local and regional level, municipal and county politicians hold a mandate from the local inhabitants. As a social developer, the county politicians need to signal the strategic direction, mobilise individuals and business/industry and coordinate the regional support structures. Through this role, the Trøndelag County Authority is a user partner in national and Nordic research projects involving energy transition. Publicly funded knowledge development that creates broad collaboration across sectors and industries will enable piloting and scaling of new solutions. This is particularly relevant for developing local energy areas to make optimal use of the existing grid and available heat resources, and qualifying Trøndelag industrial areas for project financing from national or European funding mechanisms. The fact that public discussion about energy transition is led by actors who do not have vested commercial interests reduces conflict and increases legitimacy and acceptance.

Buses seek energy and output

A national requirement concerning zero emissions in public procurement of buses was introduced in 2024. This affects the purchase of the new city buses that will operate in Trondheim from 2029. There is currently insufficient energy and output for a zero-emission solution at the bus depots. Current access to bioenergy is also a limiting factor. The county authority wants to work on new solutions through broad mobilisation of competence environments, actors from business and industry and challenges related to energy regulations.

2 From fossil to renewable

SUB-GOAL 2

Phase out fossil energy and meet energy needs by using renewable and future-oriented solutions

The transition towards a zero-emission society is well underway in the rest of Europe. The EU is working hard to attain its energy and climate goals, while increasing the security of supply and strengthening the competitiveness of European industry. Efforts to achieve the clean transition of Trøndelag industry depend on close cooperation with the regional support structure and national stakeholders. An important strategy for achieving this transition is utilising residual heat and residual raw materials from industrial processes.

How do we achieve this?

Electric vehicles

Emissions from the vehicle fleet in Trøndelag are already declining in line with the increasing share of electric vehicles. The proportion of electric passenger cars increased from 4% to 22% between 2016 and 2022. The number of electric buses and minibuses has risen from 0 to 516 since 2018 and now constitutes 19% of the total. The batteries in the electric vehicles can eventually be used by the grid companies to stabilise the grid when more intermittent wind and solar power enters the energy mix. The further electrification of light vans will depend on clear requirements in public procurement.

Decentralised production of alternative energy carriers for consumption and storage

Although battery technology development has progressed extremely rapidly in recent years and has outcompeted other energy carriers within the car and bus segment, heavy transport on land and at sea will be demanding when it comes to battery technology. New propulsion systems and energy carriers will require major new investments. All alternative energy carriers require considerable power. Co-locating fuel production with heat consumers is important for achieving a positive climate balance. Equally important is having land with sufficient access to power and space for the necessary infrastructure at port and quay facilities for shipping, and at logistics hubs for land transport. Locally produced biofuels will be important for security of supply and redundancy. Biogas can be produced from organic waste and is currently exempt from the regulation concerning emission requirements. Biogas is being considered as an alternative in the county's bus tenders. However, it is problematic to burn biological resources with the potential to remain longer in the cycle and have added value as raw materials, food or in other products.

Electrification of industry

Industry can phase out fossil energy sources by switching to electricity, recovered heat, district heating, hydrogen or biofuels. The Norwegian Environment Agency has notified of a potential ban on the use of fossil fuels in industry (Impact assessment - miljodirektoratet.no). Electrification of the process industry can contribute to increased flexibility if steam production using electric boilers is combined with thermal energy storage. In agriculture, fossil sources are used for heating and drying wood. Investment costs are the main reason that the phasing out of fossil energy sources is going slowly. The capacity of and competence in new technologies must be developed before companies can invest in and adopt such new technologies.

Electrification of the continental shelf

Off the coast of Trøndelag, OKEA ASA has received approval from the Ministry of Energy to electrify the Draugen and Njord platforms, while Equinor plans to electrify three other platforms in the Haltenbanken area using onshore power.

A comprehensive development and improvement project of grid infrastructure along the coast is planned before the oil platforms in the Haltenbanken area are electrified. These areas currently struggle with limited grid capacity. Consequently, if the platforms are electrified using onshore power, it is important that the location of transmission lines and transformer stations are planned in connection with future onshore power and grid requirements.

Trøndelag is facing a power deficit within a few years. The Trøndelag County Authority and the municipalities in Trøndelag emphasise their strong opposition to the electrification projects on the continental shelf outside the Haltenbanken area. If these projects are implemented, they will contribute to a further worsening of the power deficit in Central Norway from 2030. This will create the risk of established industrial businesses closing, lost value creation and difficulties for Trøndelag business and industry to transition in the period leading up to 2050. The success of this transition is reliant on the onshore industry in Trøndelag being able to access the available power at an affordable price.

If work to electrify the continental shelf goes ahead regardless, the Trøndelag County Authority will specify the need for assessment programmes to quantify the impacts on the price development and the regional power balance that the measure will impose on Trøndelag. Should the Draugen, Njord, Heidrun, Åsgård B and Kristin platforms a be electrified with onshore power from Trøndelag, equivalent power must be compensated to Trøndelag.

Carbon capture and storage in the industrial and energy sectors

Various energy and industrial actors rely on carbon capture and storage systems to cut greenhouse gas emissions. Carbon capture and storage technology is currently immature and is reliant on clearer carbon pricing mechanisms. Developing a value chain for carbon capture and storage or use will also require large amounts of power, heat and transport energy. Industrial actors that utilise energy technology solutions involving carbon capture and storage have projects under development in Trøndelag. Such projects have in part been triggered by the huge power demand to electrify the continental shelf. Collaboration between business/industry, research communities and authorities is required to mature technology, transport and storage before scaling to major Trøndelag emission points, e.g. waste incineration plants, smelters and limestone plants.

On the potential for improving energy efficiency in the industry:

The potential for replacing natural gas with electricity for steam production was investigated at Orkla Nidar's confectionary factory in Trondheim. The study showed that combining various technologies would reduce power requirements by 41% and greenhouse gas emissions by 30-40% (Kauko og Selvnes HighEFF Report, 2021).

3 Halt energy waste

SUB-GOAL 3

Reduce energy consumption for heating and in the transport sector by 0.5 TWh by 2030

Abundant access to and reasonable prices for electricity mean that mechanisms to improve energy efficiency, implement energy saving, or to encourage frugal use have not been systemized in administration, households or business/industry. Norwegian households have a high energy consumption per capita because of this historical abundance. Moreover, a lot of the industry is power-intensive. Instruments are therefore required not only to improve the efficiency of energy consumption, but also to stop wasteful energy use.

How do we achieve this?

Use the entire toolbox

As planning and building authorities, advisors to residents and managers of buildings and equipment for public transport, the municipalities and county authority have a key role to play in developing the future energy system for Trøndelag. Public procurement and internal measures are effective instruments because they can be carried out directly by the relevant municipality. Markets for energy solutions can be developed through requirements in the municipalities' projects. Communication and information campaigns can create understanding, acceptance and mobilisation among residents and the business sector. Regulatory instruments such as requirements in the land-use part of the municipal master plan and active ownership are effective measures for management. Grants and support schemes can provide economic incentives. Collaboration is a crucial success factor for major transitions. In this respect, the municipalities and county authority are natural facilitators of platforms and arenas for cross-sector collaboration. Pilot projects and R&D are important for demonstrating and evaluating new solutions.

Less electricity for heating

Significant amounts of electricity are consumed to heat water and air. Using alternative heating solutions will free up large amounts of electrical power throughout the year and will also significantly relieve the grid on the coldest days of the year. Better integration between heat and power is important for balancing the grid throughout the year. This will also strengthen the security of supply in the energy system by contributing to various services for heating and cooling. When assessing applications for district heating licences, it is important to use a systems perspective that considers society's heating needs. District heating can reduce the need for grid expansion. Households, public buildings and commercial properties should be incentivized to replace electricity-based heating with heat sources that offer energy flexibility. Energy monitoring systems in buildings are important tools for reducing energy consumption. Locally adapted heat sources include heat exchange technology connected to seawater, heat pumps and shallow geothermal energy. This is a win-win situation that will provide gains for energy efficiency and create opportunities for business development.

Local energy areas

A local energy area enables industry, business, transport and households to utilise common infrastructure to produce, store and distribute energy (Figure 5). Data on consumption and available capacity in district heating networks and electricity grids is useful for comprehensive land use planning and development of areas. A flexibile market makes it possible to utilise local

production and storage and to adjust or move consumption to times when energy or power is available. Using digital technology to link production and consumption more closely and to manage the power system is a core competency among Trøndelag actors and offers great business development potential. Openly accessible data developed by the municipalities of Trondheim and Oslo[1] will also provide opportunities for power companies to manage business model development for energy sharing within flexibility markets. There will be differences in the potential for utilising heat and networks between densely populated and sparsely populated areas. There is an urgent need to develop a cooperative culture in business sectors related to energy and to introduce economic incentives that promote this. Municipalities also play an important role as planning authorities setting requirements concerning energy use, sharing and storage.

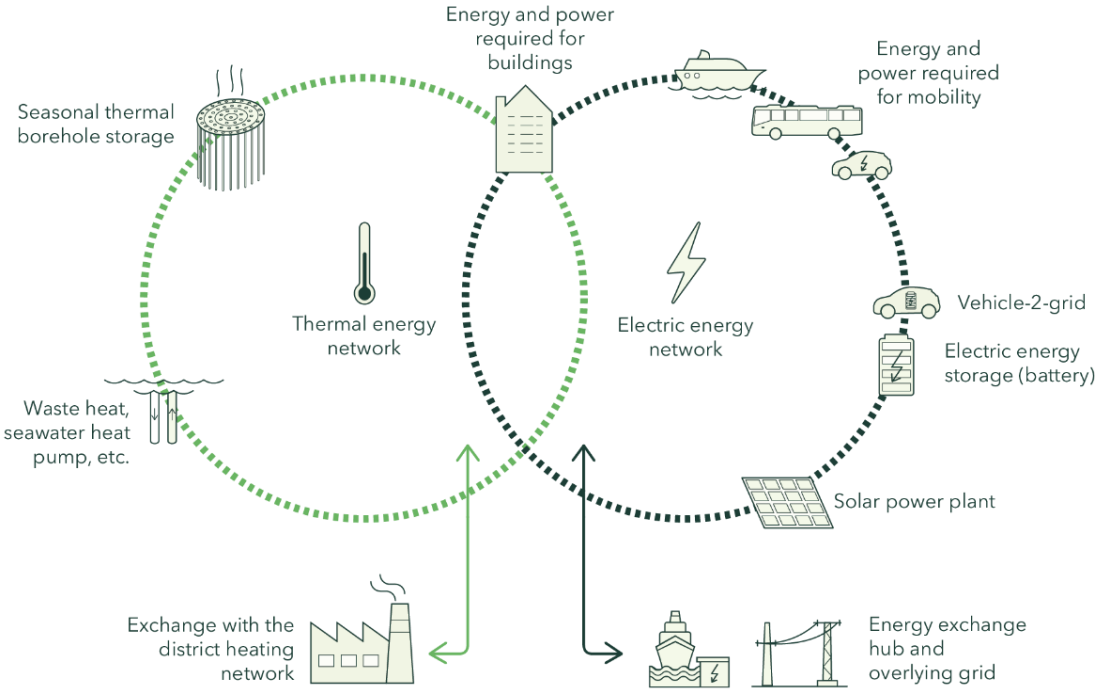


Figure 5: Local energy areas combine heat and power for production, charging, heating and storage (Source: Feasibility study for the new port, Asplan Viak).

Fair energy transition

Energy transition presents major political challenges such as how burdens and benefits are distributed. Various mechanisms must be used to ensure a fair distribution of burdens and gains. The government is developing a national electricity pricing scheme ("Norway price") to manage large fluctuations in electricity prices. Systematic work on energy saving, as well as development processes for renewable energy that protect nature and the rights of indigenous people, can increase public support and build an understanding of the need to develop new power production. The knowledge communities have involved the county authority in several research projects that seek to describe processes and a knowledge base for a fair energy transition.

[1] Planleggingsverktøy nett og varme Oslo kommune

Good news about improving energy efficiency:

In 2023, the municipalities of Tydal, Verdal, Høylandet, Snåsa, Røyrvik and Flatanger in Trøndelag received grants to improve the energy efficiency of municipal buildings. Nationally, more than 700 municipal rental homes and 800 sheltered housing units were upgraded in Trøndelag. Nursing homes with a combined capacity of nearly 2,100 residents were also upgraded. The total energy savings were almost 11 GWh. The lifespan of solar cells and windows is 30 years, while insulation lasts for at least 60 years. In addition to energy savings, these measures contribute to a better standard of living and improved indoor climate.

4 Energy and power

SUB-GOAL 4

Trøndelag will have a sufficient and secure energy supply and produce 3 TWh more renewable energy by 2035

Forecasts differ on what the energy demand and composition of the energy mix will look like in 2050. Renewable sources will contribute a significant share to a power system of the future. Given the uncertainty in the forecasts, it would be unwise to rely on one production technology to meet future needs. Instead, it is advisable to be open to power and capacity contributions from all forms of energy where regional conditions are met. All technologies for energy production have both positive and negative aspects. The common denominator is that all technologies entail land acquisition. While the developments contribute positively in the form of energy production and value creation, they also affect nature, the environment, outdoor recreation, public health, arable land and Sami interests. The Sami Parliament and the Trøndelag County Council have entered into a cooperation agreement to safeguard the natural basis for Sami culture, commercial activity and social life in the county through active and conscious planning at the county level. This agreement is particularly relevant when it comes to establishing land-intensive energy projects.

How do we achieve this?

Upgrade existing hydropower plants

Hydropower accounts for approximately 61% of renewable energy production in Trøndelag based on Trøndelag i tall (Trøndelag in figures). The potential for new, large-scale hydropower production in Trøndelag is limited, but there is potential to upgrade and expand existing hydropower plants. Such efforts should be encouraged for two reasons. Firstly, there have already been significant land acquisitions. Secondly, such projects can be completed far quicker than completely new projects. The realistic potential for such upgrades is estimated to 6-8 TWh in Norway (NVE, 2020). It is difficult to obtain accurate figures for the upgrading and expansion of hydropower plants in Trøndelag. The realistic potential will depend on the type and age of the hydropower plants, as well as watercourse conditions.

Three revisions of license terms have been opened by the Norwegian Water Resources and Energy Directorate (NVE) in Trøndelag, with the aim of improving the environmental condition of watercourses used for hydropower. The environmental objectives for parts of the Nea-Nidelv watercourse are so strict that this may entail a loss of power production. Upgrading and expansion of hydropower in Trøndelag must consider the environmental objectives for water stipulated in the Regional plan for vannforvaltning (Regional plan for water management) in the Trøndelag Water Region. The plan is based on national and international guidelines concerning environmental objectives and is grounded in the EU Water Directive. The plan emphasises protected watercourses

as being particularly important. Consequently, power development is not possible in such areas if Norway is to fulfil its obligations under the EEA Agreement.

As of September 2024, projects totalling 0.2 TWh of new hydropower were under consideration by NVE in Trøndelag. It remains uncertain how many of these projects will receive a licence. It is worth noting that several projects that previously received licences were not started and have now exceeded their implementation deadline.

Wind power on already developed areas

Owing to large-scale developments, wind power accounts for 38% of renewable energy production in Trøndelag. Land-based wind power is among the cheapest alternatives for new power production in Norway and the one that may be realised the quickest (NVE, 2023). Furthermore, it is the form of production that has the highest potential to increase power production in Trøndelag in the short term as it is the most profitable.

Clear land conflicts exist between wind farms and reindeer herding. The Regional Land Use Plan 2022-2030 (RPA) states that new areas should not be allocated for land-based wind power development until knowledge about the consequences of licensed and ongoing wind power development has been collected and fully assessed. It is unlikely that there will be any major land-based wind power in untouched nature in Trøndelag before 2030, but as of May 2025 eight projects were under consideration by NVE. These projects have a total expected energy production of 4.5 TWh annually. The reasons wind power is not being developed are the combined burden on natural areas, limited grid capacity and reindeer herding interests. Moreover, wind power projects have faced opposition from the local community. Land-based wind power requires municipal acceptance and must be balanced with reindeer herding interests.

Increased energy production from land-based wind power should be viewed in connection with the upgrading and expansion of existing wind farms within designated areas. Production on a smaller scale should also be considered. This involves farm windmills, wind power on brownfield sites and community-based energy projects. Technology development is underway on wind turbine concepts that may make smaller scale systems relevant.

Use roof surfaces for solar power

Solar power only accounts for a small share of Trøndelag's power production. In 2023, 7 GWh of solar power were connected to the grid. This is lower than the total solar power production as this figure does not include solar power that covers the producer's own consumption. Although the share of total energy produced is low, solar power is experiencing strong growth. Solar power production in Trøndelag has tripled since 2020. It is necessary to look at where solar power is developed, to ensure local consumption. A disparity between production and consumption will necessitate costly measures to increase transmission capacity.

As of November 2024, there were no solar power projects under licensing consideration in Trøndelag (NVE Solar power). There are currently no large commercial ground-mounted solar power plants in Trøndelag. However, there are pilots, including at Skjetlein upper secondary school. In principle, it is undesirable to place ground-mounted solar power on arable land or in forest areas.

Solar power should be combined with energy storage and other energy harvesting technologies such as batteries, energy wells, solar collectors and wind power. It will be important to utilise brownfield areas, e.g. roof and wall surfaces, for solar power production. This is preferable to solar power on arable land and in forest areas.

Utilise local raw materials for bioenergy and heating resources in householdings and business and industry

Small-scale local energy production using solar, wind, geothermal energy, heat and residual raw materials from water and wastewater, manure and wood chips is important for achieving increased redundancy and preparedness.

Utilising bioenergy and heat resources can meet heating needs in households and commercial buildings. Incineration of materials provides the lowest utilisation rate. Sound resource management calls for bioresources to be used as materials in the economy before being burned. Bioenergy utilization reduces vulnerability to power price variations and eases the power grid on the coldest days. In principle, local heating and district heating are quite similar in terms of production and distribution. The main difference is the size. In Trøndelag, district heating covers around 3.5% of energy consumption (Energidashbord, 2022). Almost half of the district heating is recovered from the waste incineration plant at Heimdal.

Bioenergy covers approximately 3% of energy consumption in Trøndelag. The largest share is firewood, wood chips and pellets that are burned and used for heating. Biogas is produced at five locations in Trøndelag, as well as at several farm facilities.

Using available residual raw materials in Trøndelag for biogas production could provide 1.7 TWh[2]. However, this requires the collection and use of all waste from farming, manure and the redistribution of other residual raw materials from various uses. Ongoing pilot projects remain in the early stages, and success will depend on technological developments and regulatory support. Regulatory conditions may lead to intensification of collection requirements.

Explore and understand the potential for offshore wind power

Offshore wind power is a major commitment for the further development of the Norwegian continental shelf. As maritime and marine technology expertise already exists after many decades in the petroleum industry, Norway and Trøndelag are both well-positioned to succeed with offshore wind power. Nordvest B and Nordvest C, located off the coast of Trøndelag, are two of the strategic assessment sites for offshore wind power. Both areas will require floating offshore wind power technology, which is under development but extremely expensive. Nordvest B has a favourable location regarding the electrification of the oil platforms in the Åsgård field. Statnett recommends Fræna as a connection point for offshore wind power. Fræna is situated in Møre og Romsdal county in zone NO3, the same as Trøndelag.

The current Nordvest B and Nordvest C sites are much larger than what will ultimately be announced. It will be important to be involved in NVE's strategic impact assessments to ensure local input concerning which sites should be prioritised or possibly reduced in size. The areas outside Trøndelag are not included in the call for proposals to be announced in 2025. As floating offshore wind power is such an immature and expensive technology, it is unlikely that it will be able to contribute to production before 2040. It will be important for Trøndelag that the offshore wind power investment safeguards the sector's interests at sea and contributes to local onshore value creation.

Nuclear power: more knowledge is needed

Several municipalities in Trøndelag have expressed interest in nuclear power. Norsk Kjernekraft AS has submitted a proposal for an assessment programme for the establishment of a nuclear power plant in the Taftøy business park in Aure and Heim municipalities to the Ministry of Energy. Consequently, Trøndelag could thus become a pioneer county for nuclear power in Norway. Based

[2] Restråstoffkartlegging, Trøndelag i tall

on the assessment programme, the nuclear power plant is expected to consist of several small modular reactors (SMR) with a combined output of 1500 MW. The SMR concept is an interesting addition to the nuclear power debate as it requires little land area in relation to the amount of energy produced, is scalable and represents a stable energy source.

SMR is currently in its early stages. Around 70 to 90 design prototypes are under development globally, but none of these have been built yet. Consequently, SMR technology is not mature or commercially available. A series production of SMR is appropriate from an industrial perspective. However, this appears unlikely during the next decade since none of the prototypes have been tested in commercial operation. Moreover, there are large discrepancies in the cost estimates. The most optimistic estimates show that the costs for SMR technology will be at the same level as conventional nuclear power.

Norway currently lacks regulatory frameworks and expertise for construction, operation, maintenance and waste management nuclear power facilities. The Ministry of Energy has appointed a public committee to assess nuclear power as a possible energy source in Norway. The introduction of nuclear power in the Norwegian energy system will create a significant change because reactor fuel must be imported and handled after use. Introduction of power from a nuclear power plant will also have consequences for grid development and capacity. The committee will need to assess the socio-economic cost of such an introduction.

Table 1: Development projects under consideration by NVE in Trøndelag. Solar power and district heating, offshore wind power and nuclear power are supplemented by potential from other mapping.

Energy source	**Projects under consideration by NVE in Trøndelag**
Hydropower	0.25 TWh (NVE's licensing database)
Land-based wind power	4.5 TWh (NVE's licensing database)
Solar power	0 TWh (NVE's licensing database) *0.9 TWh potential in Trøndelag on buildings at business parks*[3]
District heating	0.4 TWh (NVE's licensing database) *2.6 TWh (possible annual power saving by using district heating)*[4]
Offshore wind power	0 TWh under licensing consideration *8.2 TWh estimate from NVE for the offshore wind power areas Nordvest B and Nordvest C*
Nuclear power	0 TWh under licensing consideration *The assessment programme for nuclear power at Taftøy Business Park: 1500 MW installed capacity and approximately 12.5 TWh annual production when fully operational.*

[3] Teknoøkonomisk potensial for solkraft på bygg – Multiconsult

[4] Potensial for fjernvarme i byggsektor Sintef 2021

5 Investments in infrastructure

SUB-GOAL 5

Trøndelag will increase flexibility in the use of the grid and heat and utilise solutions for storing and sharing energy across days and seasons by developing five local energy areas

Infrastructure required to distribute energy over distances and time include power grids, district heating pipes, energy wells, electricity storage in batteries, seasonal storage of thermal heat and charging/refuelling points. Flexibility in the energy system involves shifting consumption from day to night or storing heat from summer to winter. The need for flexibility will increase as fossil energy sources are phased out and more intermittent power is introduced into the system. Flexibility requires investments in infrastructure such as heat storage, waterborne heat systems or batteries. The use of AI provides new opportunities to utilise the capacity of the power system more efficiently but is also very energy intensive.

How do we achieve this?

Here in Trøndelag, we have the physical infrastructure, such as power plants, power grids and heating networks, and the digital infrastructure, such as smart meters, sensor technology and energy system models, required to develop robust energy solutions for the future. The digital infrastructure enables us to automate, develop comprehensive system solutions and adapt consumption to production and local storage solutions.

New grid and security of supply

Power supply is defined as a fundamental national function. Redundancy means the system will still function even though one component fails. Electrification of the transport sector will involve changes to redundancy requirements and how we plan to ensure security of supply and emergency preparedness.

An important project for Statnett is completing the 420kV connection between Namsos and Sunndalsøra. This is scheduled for completion by 2030. Statnett points to the need to strengthen the east-west grid between Trøndelag and Sweden, as well as north-south between NO3 and NO2. These requirements are not part of Statnett's target grid by 2040 (Figure 6) and have not been investigated. Investments in infrastructure are not profitable in the short term.

Figure 6: Target grid for Statnett 2040 (Source: System Development Plan Statnett 2023).

If an industrial establishment triggers the need for investments in the grid, the grid company will issue a binding offer regarding the grid investment contribution. Tensio's long-term financial plan envisages an investment level of approximately NOK 1 billion annually through to 2033. This includes a new grid, upgrading of important cable and line connections, as well as replacement, renewal and capacity increases in transformer stations in urban areas where demand is rapidly rising. The regional grid capacity between Indre Fosen/Ørland and Orkland municipality must be increased to ensure security of supply for critical infrastructure at the port and logistics serving Norway's total defence.

Well-functioning democratic licensing processes are an essential part of safeguarding the breadth of societal interests affected by infrastructure development. Important considerations for Trøndelag include responsibility for the South Sami cultural heritage and how the reindeer herding activities are affected by new infrastructure.

Energy coordination

Under national regulations, all grid companies are required to take on an energy coordination role. In practice, this involves ensuring better utilisation of the production resources, the grid capacity and customer flexibility that exist within the current energy system. Tensio's ambition is that various measures will increase the utilisation rate of existing infrastructure by up to 25% by 2027.

Energy consumers in industry and at and business parks are spread across various Trøndelag municipalities. They have different storage options such as batteries, hydrogen and heat wells, and will need to coordinate the use of power and heat resources across sectors and industries. Tensio will have greater success in its active role if the municipalities in Trøndelag use their roles as planning authorities to contribute to this effort when it comes to comprehensive planning of areas, energy and transport. The regional energy coordinators can contribute to better planning of energy infrastructure. An updated and revised scheme gives grid companies more flexibility for tighter grid operation and enables the best possible delivery reliability for society in the energy system of the future. This will be particularly important for reducing risk when conditional grid connections increase in scope.

Prioritisation of connections

Projects related to hydrogen production; battery production and industry have currently reserved approximately the same grid capacity up to 2030[5]. These value chains are all prioritised in the national roadmap – "The green industrial initiative". These projects will create different levels of employment, value creation and ripple effects in various parts of the county. Meanwhile, the electrification of several platforms in the Haltenbanken area is also being planned. The connection obligation, the principle of "first come, first served" and maturity criteria determine who is allocated grid capacity. As electricity is a scarce resource, consideration must be given to whether additional connection criteria should be developed. National guidelines should be used when prioritising grid connection, as the power grid is integrated. Creating accurate, fair and viable rules for prioritising connection will not be a simple task. There is currently no knowledge guidance for prioritising existing industry over new industrial establishments. Moreover, no good methods exist for comparing the ripple effects, employment outcomes or climate impacts of different energy-intensive industries.

Horizon towards 2040 and 2050

The future development of energy production and increasing demand for power involve many political issues related to the distribution of disadvantages and costs, and weighing up matters related to the speed of change and acceptance of changes. Policy related to industry, innovation and climate will be closely linked to geopolitical issues, including energy policy.

The Trøndelag County Authority believes that national authorities must facilitate opportunities for regional actors to express their opinion about the location and planning of major energy projects. The current practice does not allow regional authorities any input when decisions are made about the location and prioritisation of new measures being established in the region. One consequence of this is electrifying the continental shelf using onshore power.

It is unfortunate that Trøndelag is divided into several bidding zones. This is an area the region wishes to influence. Planning and development of the grid capacity between Tydal and Røros is another important issue for the region.

Some of the most important issues in Trøndelag will be:

- Discussion is required about integration in the Nordic energy market. Prices will be affected as the share of intermittent power increases, and the share of fossil fuels decreases. This will lead to prices changing faster and an emergence of new dependencies related to supply chains and technology.

[5] Kraftløftet analysedashboard (nho.no)

- We will be exposed to cyberattacks as control systems are digitalised further. If the geopolitical unrest continues or intensifies, we will need a higher level of digital and physical security and preparedness.
- Floating offshore wind power off the coast of Trøndelag can contribute to onshore electricity and power and commissions within the service and supply industry with competence related to offshore activity. Floating offshore wind power will also require significant areas at port and quay facilities as well as at sea. Interaction between all marine industries will require new management measures. Floating offshore wind power off the Trøndelag coast will also require an upgrade of grid infrastructure.
- When the activity in the Haltenbanken area is phased out, the strategic direction for industrial development in Trøndelag involves a discussion about which sectors or value chains should be given priority.
- The possible integration of nuclear power into the Trøndelag energy system will require developing capacity and competence related to labour, within management and at the political level locally, regionally and nationally.
- Cutting greenhouse gas emissions will be necessary to maintain the competitiveness of cornerstone companies in Trøndelag, as the emissions trading scheme is the EU's most important climate policy instrument. As the quota volume is reduced each year, the cost of greenhouse gas emissions will increase. Consequently, emissions cuts will be necessary to keep production costs down.

Facts about the EU's work involving energy and industry

The EU Clean Industrial Deal describes the steps Europe will take to accelerate the decarbonisation of energy-intensive sectors such as steel, metals and chemicals and transition to clean energy in all sectors to reduce dependence on fossil fuels. The Deal describes the development and up scaling of clean technologies through support for research and innovation. It includes actions to promote the circular economy, such as reducing waste and increasing recycling and reuse. Significant means will be allocated to support the transition to a clean industry, including more than 100 billion Euros in financing. Finally, the EU deal takes action to reduce energy costs and ensure fair carbon pricing for European industry. The Deal and the EU in general are increasingly concerned about increased recycling and extraction of minerals and raw materials in Europe. This is part of a security policy strategy designed to secure value chains and strengthen competitiveness. Several of the EU's strategies are reflected in priority areas and overlapping strategies in this regional plan for energy transition. The aim of the Deal is to shorten European value chains, which is also positive for Trøndelag.

Active involvement in European energy projects and programmes, such as Horizon Europe, will enable Trøndelag actors to benefit from European expertise and funding, which will strengthen the region's efforts. Such involvement can help position Trøndelag as a leading region in sustainable energy development and decarbonisation in Norway – and perhaps also in Europe.

Useful links

- Mapping of the energy technology community in Trøndelag
- Riksrevisjonens rapport om kapasitet i strømnettet
- Statnett's System Development Plan 2023
- Trondheim's Energy and Climate Plan
- Rapport: Virkemiddelanalyse for energi i Oslo (klimaoslo.no)
- DNTs Landsmøteresolusjon om energipolitikk innenfor naturens tålegrenser
- Fjernvarme, barrierer og virkemidler
- Industrien: etterspørsel etter kraft, beslutningsfaktorer og energieffektivisering
- ZEROrapporten 2025
- EnerSea - Delrapport L1 1.pdf (unit.no)
- Handlingsplan for energieffektivisering
- Energimerkeforskrift
- Hvordan bruke mindre energi i kommunale bygg? - Norsk Kommunalteknisk Forening (kommunalteknikk.no)
- NVE Rapport 18/2024: Scenarioer for kraftmarkedet 2024.
- Energisystemet mot 2050 -drivkrefter og trender (Energi21)
- Hva er e-fuel, Klimastiftelsen 2020
- Trender og muligheter NHO Elektro
- Kjernekraftutvalgets mandat
- Års- og bærekraftrapport 2023 Tensio
- Forslag til nasjonal ramme for vindkraft, NVE 2019
- Biogassplattformen er lansert! - Biogass Norge
- På lag med mennesker og natur - veikart for fornybarnæringen (fornybarnorge.no)
- Kystkrafta
- Spørsmål og svar om energieffektiviseringsdirektivet - regjeringen
- Samarbeidsavtale mellom Sametinget og Trøndelag fylkeskommune 2023–2026
- Veileder for kommuner og fylkeskommuner om konsultasjoner med samiske interesser
- Rapport fra NIM - Menneskerettslig vern mot inngrep i samiske bruksområder
- Sametingets planveileder

(NB: Titles are only listed in English if the publication is available in English.)

Action plan for Trøndelag 2025-2029

What will we work on over the next four years?

Sub-goal	No.	Action
The role of the county authority and the municipalities	1	Dialogue with national authorities and provide guidance to municipalities for coordinated planning of land, energy and transport
	2	Contribute to business development and value creation by increasing local energy production, energy efficiency and flexibility solutions
	3	Utilise buildings for energy harvesting, storage, charging and sharing
	4	Offer education programmes that provide the necessary competence for energy transition
	5	Invite relevant actors to the Cooperation Forum for energy transition
	6	Dialogue with other counties and relevant Trøndelag municipalities to map possible alternatives for distributing concession power
	7	Develop a communication plan for work energy and industry
From fossil to renewable	8	Map the need to allocate areas for charging and refuelling infrastructure for alternative energy carriers within air, sea and heavy transport
	9	Work to achieve emission-free solutions on building and construction sites
	10	Utilise good passenger base on short flight routes as a competitive advantage for testing new propulsion systems such as electric aircraft
	11	Develop new cooperation models with public and commercial actors to ensure there is sufficient energy for zero emissions in public transport
	12	Contribute to ZERO's project to achieve better preparedness in the renewable transport sector
Stop wasting energy	13	Map surplus heat and opportunities for flexibility in industry and commercial areas
	14	Emphasise energy consumption and not just climate requirements when assessing alternatives within roads and transport
	15	Support municipalities and business/industry with planning to utilise waste heat from existing and new industry
	16	Coordinate measures from various actors to reduce energy consumption by the residents and in the public and private sectors
Energy and power	17	Prioritise upgrading and expanding existing hydropower plants
	18	Prioritise upgrading and expanding the capacity of existing wind farms within designated areas
	19	Use economic instruments to facilitate small-scale wind power on brownfield sites and already developed areas
	20	Plan how to assess the overall impact of wind power development in Trøndelag
	21	Map the potential to increase utilisation of the energy resources in Trøndelag
	22	Use economic instruments to make industrial biogas plants possible that utilise 30% of Trøndelag's livestock manure in biogas production
	23	Promote cross-sectoral cooperation between knowledge communities and business clusters related to aquaculture and floating offshore wind power
	24	Assess the role of nuclear power in the energy system in Trøndelag once the nuclear power committee has submitted its report
	25	Support regional geographical development areas where value creation, new energy consumption and new energy production are seen in connection
Investments in infrastructure	26	Strengthen comprehensive planning of land, energy and transport through competence development and guidance
	27	Make charging and refuelling infrastructure for public transport available to other actors
	28	Contribute to realising the central grid connection between Namsos and Sunndalsøra, while safeguarding Southern Sami interests
	29	Contribute to developing connection criteria beyond maturity to ensure predictability for existing and new industries

Who needs to contribute?

The objectives of phasing out fossil energy sources, reducing energy consumption, investing in infrastructure and new energy and capacity in Trøndelag require the county authority and municipalities to use their roles to collaborate with knowledge communities, business/industry and interest organisations. It is natural to combine the entire toolbox of instruments – economic, regulatory and networking.

The Trøndelag County Authority will take the initiative to establish a forum for energy transition. The county's political and administrative leadership will take part. Natural participants include Tensio and Trøndelag's largest power consumers and producers. The intension is for participation to be non-binding and for the forum to take place annually at an existing meeting place.

The Trøndelag County Authority will also invite interested parties within the plan's five thematic areas to work out how to follow up common goals and activities.

Table 2: Key actors and partnerships

Areas of responsibility	County-municipal-regional collaboration arenas and partners
The municipalities have local responsibility for: • community planning • land development The county authority has regional responsibility for: • planning, cultural heritage, land use and water management plan • transport including the county road network and public transport • business development including the regional support structures • competence, including upper secondary education Governmental authorities have national responsibility for: • emergency preparedness for power supply • licensing related to development of the power system • planning and development of the transmission grid • national infrastructure including the national road network, airports and ports • business-oriented support structure • the higher education sector Regional power and grid companies have regional responsibility for: • constructing, operating and maintaining power stations, regional grids and distribution grids • emergency preparedness for power supply	Næringspartnerskapet Trøndelag Kompetanseforum Trøndelag (Trøndelag Competence Forum) Regionalt klima- og naturutvalg (Regional climate and nature committee) Ungdommens fylkesutvalg (Youth advisory committee) Regional cooperation (in the regional planning strategy) Regional planning forum Clusters, innovation environments and business incubators Intermunicipal political council (IPR) Planning network NVE SSB SIVA ENOVA Research Council of Norway FNF Trøndelag Grønt Hjerte AS The Centres for Environment Friendly Energy Research (FME) and other R&D projects Trondheim Science Centre

How was the plan compiled?

The plan's knowledge base utilises official statistics from Statistics Norway and other statistics published on Trøndelag i tall. It also includes the knowledge base published here on the county administration's website. An external resource group consisted of representatives from Grønt Hjerte, TrønderEnergi, Aneo, NTE, Statkraft Varme, Tensio, Statnett, Renergy, the Institute for Energy Technology (ITE), Sintef Energy Research, Forum for Natur og Friluftsliv (FNF) and the municipalities of Trondheim and Hitra.

Physical and digital meetings were held with various stakeholders in Trøndelag, including municipal politicians, administrative employees, business/industry, knowledge communities, youth and the Sami committee, as part of board public participation that lasted until April 2025. Please check the website for more information and the submissions received.

Glossary

- **Energy:** Is in theory the ability to perform work or heat. Measured in Joules (J) or often kilowatt hours (kWh). Energy can be expressed in several forms, e.g. electrical, chemical, thermal or mechanical.
- **Power:** The amount of energy transferred or converted per unit of time. Measured in watts (W) and often given the prefixes kW or MW. High power means that energy is converted or transferred rapidly. The immediate consumption of electricity is called electric power consumption.
- **Energy balance:** The ratio between the total production of energy and the consumption of energy during a specific period.
- **Power balance:** The ratio between the supply and use of power at a specific point in time. Power consumption differs from energy consumption in terms of time: Electricity consumption is a form of energy consumption over time, while electric power consumption is electricity consumption at a specific moment.
- **Installed capacity:** The maximum output a power plant or installation can produce or handle
- **Flexibility:** As electricity is a fresh commodity, production must always be in balance with consumption. Flexibility is the ability to switch between heat and power, and between production, storage or consumption.
- **Security of electricity supply:** The ability of an electricity system to provide end users with an uninterrupted supply of electricity of a specified quality
- **Power grid:** The infrastructure that transports electric energy from the producers to the consumers. It is divided into three levels:
    - **Transmission grid:** Previously called the central grid. Covers the entire country and connects the Nordic and European power markets. Statnett is the main operator.
    - **Regional grid:** Covers regional areas and acts as a link between the transmission and distribution grids. Operated by regional grid companies.
    - **Distribution grid:** Covers smaller geographical areas, such as towns and villages. Operated by regional grid companies.
- **Carbon capture and storage:** Using carbon capture technology to capture emissions from industrial processes. There are two categories: carbon capture and storage (CSS) and Carbon capture and utilisation (CCU).
- **Hydrogen:** The difference between blue, green and grey hydrogen lies is the production method: Grey hydrogen: Produced from natural gas without carbon capture. Blue hydrogen: Produced from natural gas including a process to capture and store carbon Green hydrogen: Produced using electrolysis powered by renewable energy sources