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Economic impact analysis of a new data centre in Hamar

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The purpose of this study is to analyse the economic impact of a new data centre at the Heggvin site between Hamar and Elverum on the regional and national economy.

The study gives a short overview of the current data centre industry in Norway and Hamar as an economic region, before presenting the results from the economic impact analysis measured both in the form of employment and as a contribution to GDP. At the end of the report, we briefly look at the potential that lies in using waste heat from the data centre at Heggvin.

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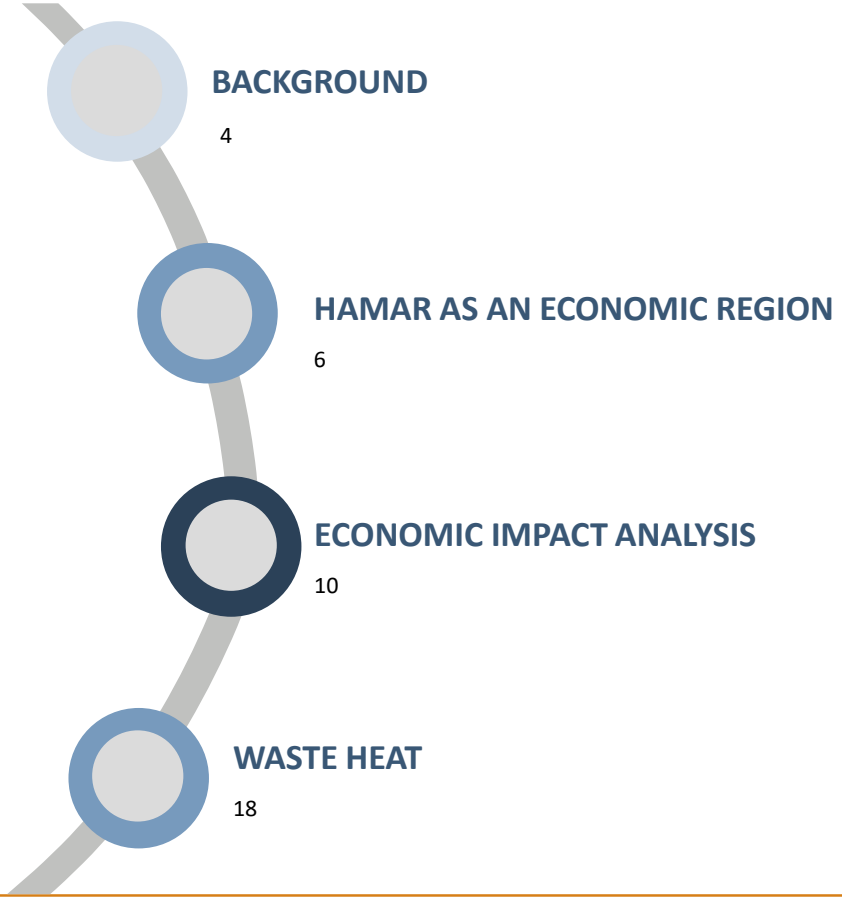


The Norwegian data centre industry

On a global scale, there is an increasing demand in digital services, and as a result a huge growth in the volume of data being produced, stored, copied, and consumed every day. This growth in data generation leads to an increased demand for data centre services, which can lead to increased productivity, cost savings, agility, and use of new technologies in businesses.

Norway offers plentiful renewable energy at a relatively low cost, in combination with excellent infrastructure and connectivity, a highly competent workforce, and experience with power-intensive industries. This makes Norway an attractive country for establishing data centres. The Norwegian government launched its first data centre strategy in 2018 with the goal to attract and develop a new industry that creates jobs and contributes positively to GDP in Norway.[1]

In 2021, the strategy was updated to meet new challenges. The following are the main actions the Norwegian government will take as part of its updated data centre strategy:

- Strengthen marketing of Norway as a data centre nation
- Increase competitiveness
- Facilitate sustainable development
- Strengthen the digital foundation

According to the Norwegian data centre strategy from August 2021[3], the industry mainly consists of six large companies and some smaller operators. The six largest companies account for about 70 percent of the industry's capacity, with an average installed capacity of 16 MW. The smaller companies have an average capacity of approximately 1 MW.

Collectively, the industry had a capacity of about 105 MW divided among 18 data centres, according to a study conducted by Implement Consulting[2]. However, a handful of new data centre locations have been built since the study was conducted in 2020. The same study also found that the data centres generated NOK 1.5 billion in direct value to the Norwegian economy in 2019 and employed more than 1,000 persons.

1) https://www.regjeringen.no/contentassets/0eabdbcbfb2540699466a4a1a801d737/en-gb/pdfs/h-2510-e-datasenterstrategi.pdf
2) *Implement Consulting Group (2020): Datasentre i Norge – Ringvirkningsanalyse av gjennomførte og potensielle etableringer*
3) https://www.regjeringen.no/contentassets/0eabdbcbfb2540699466a4a1a801d737/en-gb/pdfs/h-2510-e-datasenterstrategi.pdf

Key information about the new data centre in Hamar

An international client has chosen Green Mountain to provide data center services in Europe. Green Mountain will build and operate a hyperscale data center in the municipality of Hamar for this purpose.

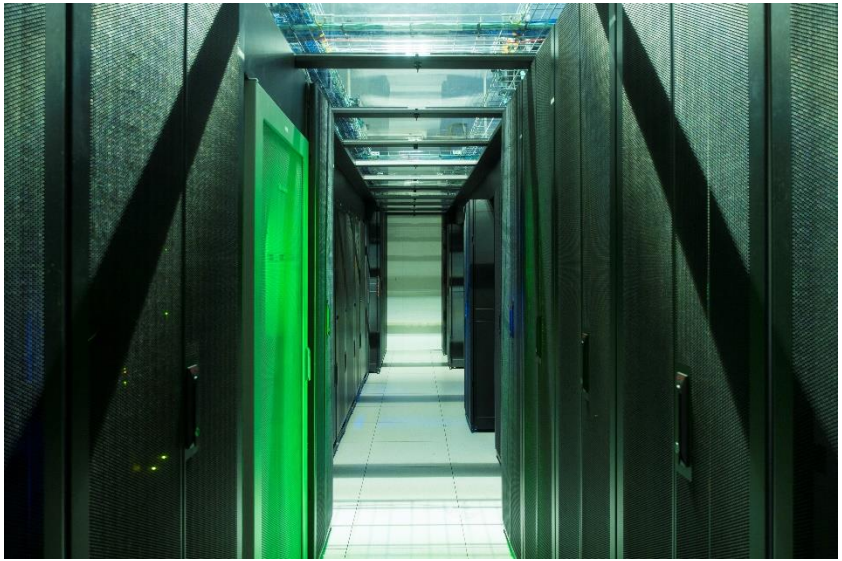
The data centre will be built at the Heggvin site between Hamar and Elverum and will, at full development, consist of 5 buildings of equal size. Each building will have a capacity of 30 MW. This means that the total capacity of 150 MW will exceed the capacity of all data centres currently in operation in Norway.

The construction process of the data centre started in November 2022 and is expected to take 12 months for each building. Construction of a new building will start every 4 months so that the buildings will be constructed in parallel.

After each building is built, it will take the client approximately three more months to install the equipment before the centre is operable. This means that the capacity in operation gradually increases until all buildings are operable at full scale in July 2025.

CTS Nordics is the chosen contractor of the project and Green Mountain will invest approximately NOK 11.5 billion directly in the building project. It is expected that there will be on average 400 workers on site during the whole construction period. Green Mountain will invest another NOK 2 billion in the construction period. This cover, among other, costs related to acquisition of land and energy infrastructure on site. In addition, the client of the data centre will be responsible for purchasing servers and other equipment.

Foto: Green Mountain



Hamar as an economic region

Employment in the Hamar region today

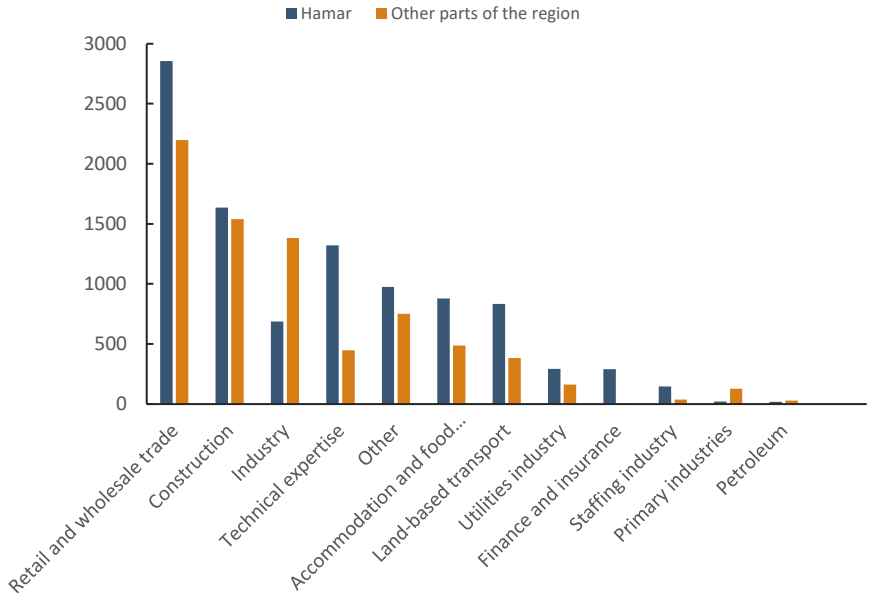
The data centre at Heggvin will have large economic effects in the Hamar region. In this analysis we define the Hamar region as the municipalities of Hamar, Elverum, Løten and Stange. Before we start analysing the expected economic impacts on the region from a new hyperscale data centre, we start with a brief overview of the Hamar region as an economic region.

The population of the Hamar region has been relatively stable over the last decade. In 2022, it reached more than 82,000 people, an increase of almost 6,500 during the last ten years. Hamar is by far the largest municipality in terms of inhabitants in the region. The labour markets in the four municipalities are integrated to a large degree with significant commuting across municipalities.

In 2021 the number of employees in the Hamar region was 38,500, with 58 percent employed in the private sector. The number of employees has been stable over the last decade, both in the private and the public sector.

The two largest sectors in the private sector in the Hamar region are retail & wholesale trade and construction when measured in number of employees. As shown in the graph to the right, construction employs more than 3,000 workers in the region, while the number of employees in retail and wholesale trade is as high as 5,000. In the industrial sector there are more employees in the municipalities of Elverum, Stange and Løten, while the number of employees within technical expertise is much higher in Hamar municipality.

Number of employees in private companies in the Hamar region. 2021. Source: Menon Economics



Value creation in the Hamar region today

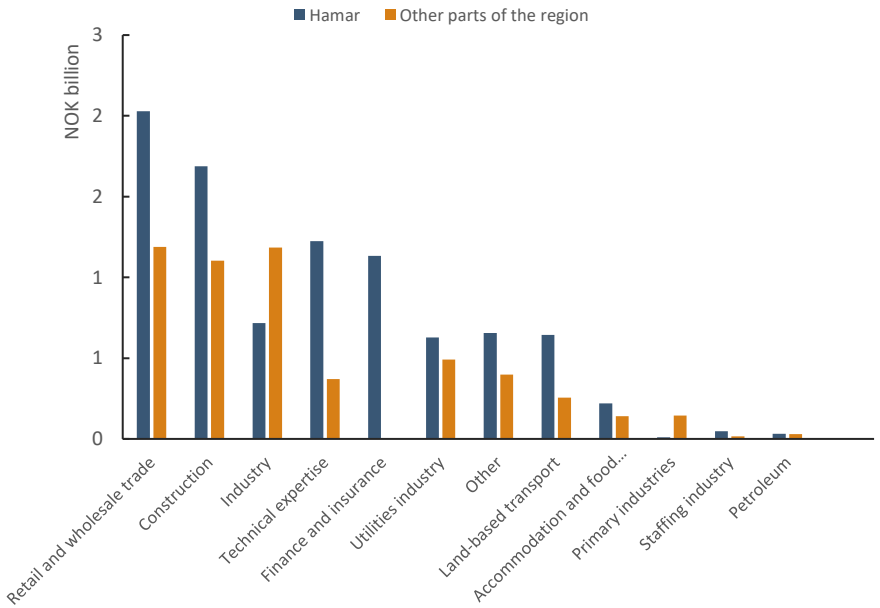
In 2021 the total value creation by the private sector in Hamar region amounted to NOK 16.8 billion. This represents an increase of close to 90 percent during the last ten years.

As with employment, the retail & wholesale trade and the construction sector are dominant in both the municipality of Hamar as well as the broader Hamar region. The value creation from the two sectors combined was as high as NOK 6 billion, accounting for 37.5 percent of total value creation in 2021.

The fact that the construction sector is so large in the region is very relevant in terms of the economic impacts of the data centre. The presence of a regional construction sector suggests that a relatively large share of the investments in the construction phase will go to local suppliers and contractors.

For the other three municipalities combined the industrial sector represents one of the largest value creation. The largest three industrial companies in these municipalities in terms of value creation are Furnes Jernstøperi in Stange, Orkla Foods department in Elverum and Veidekke Industri in Elverum and Stange. These companies contribute to total value creation in the region with 148 million NOK, 116 million NOK and 97 million NOK, respectively.

Private value added by sectors in Hamar region. 2021. Source: Menon Economics



The labour force in the Hamar region

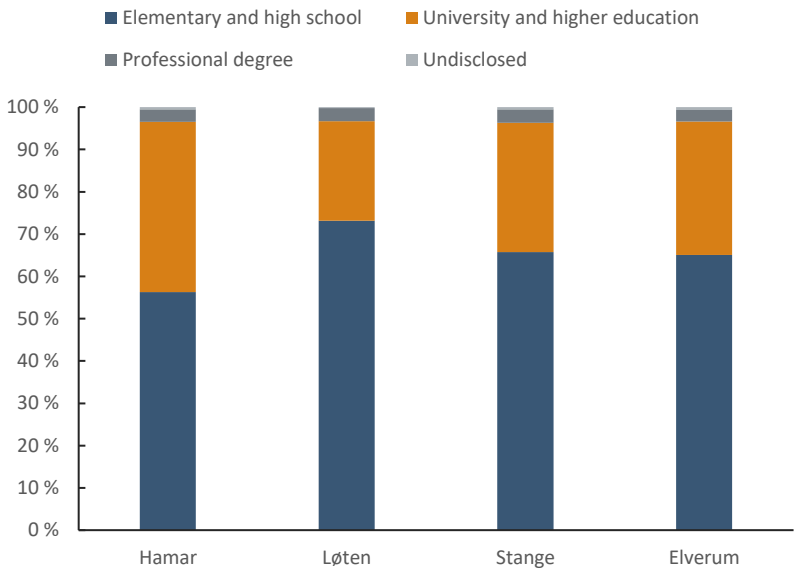
Establishing a data centre of this size requires a substantial number of employees. Today's educational level and unemployment rate in the region form a starting point for what we can expect as an impact in the region.

Looking at the educational level of the workforce, we find that approximately one third of the population have a university or other higher education degree. In the municipality of Hamar, more than 40 percent of the population has a university degree. This share is lowest in the municipality of Løten with 23 percent of the population. In comparison, on a national level the share of the population with a university degree is approximately 25 percent (2021).

A large share of those who will be employed at the data center will have professional backgrounds such as electricians, mechanics and the like. Most of these have completed high school and received a professional certificate after completing their apprenticeship. The professional degree in the figure on the right side includes those who have taken further studies after high school, usually after having worked for some years. According to data from NAV and Statistics Norway, the unemployment rate in the county of Innlandet, which the Hamar region is part of, has been low and stable over the last decade. Currently, the unemployment rate in the county is hovering around 1.5 percent. In Hamar and Løten the rate is 1.6 percent, while in Stange and Elverum the number is slightly higher at around 1.9 percent.

The low and stable unemployment rate indicates that the labour market in the area has been relatively resilient, but also that there is little available labour in the region today.

Educational level in the Hamar region. Source: SSB



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Economic impact analysis of a new data centre in Hamar

ECONOMIC IMPACT ANALYSIS

ECONOMIC IMPACT ANALYSIS – MAIN FINDINGS

In full operation, the hyperscale data centre is expected to **support 300 full-time equivalents** (FTEs). 225 of these employees will be working directly at the data centre, while the remaining 75 FTEs will be working for the suppliers of the data centre.

Furthermore, the operation is estimated to annually **contribute NOK 260 million to Norwegian GDP**. About NOK 160 million of this will be directly related to the operation of the data centre, while roughly NOK 100 million in value creation will stem from the suppliers of the data centre.

The construction phase is expected to support roughly 8,300 FTEs. The main contractor expects that there will be an average of 400 FTEs working at the physical site throughout the construction period. The remaining employment effects will accrue to other Norwegian businesses both within and outside the county of Innlandet.

In addition, the activity in the construction phase will contribute roughly NOK 9 billion to GDP. Of these 9 billion NOK, 4.7 billion NOK will be directly related to the construction. NOK 4.3 billion will be value added further upstream in the value chain.

While the construction phase only lasts for about two years, and the employment and value creation are temporary, the operation phase will generate jobs and value creation for a longer period of time.

Main findings:

Annual FTEs from operations
300

Annual contribution to GDP:
260 mNOK

Total FTEs during construction
8,300

Economic impact analysis – an introduction

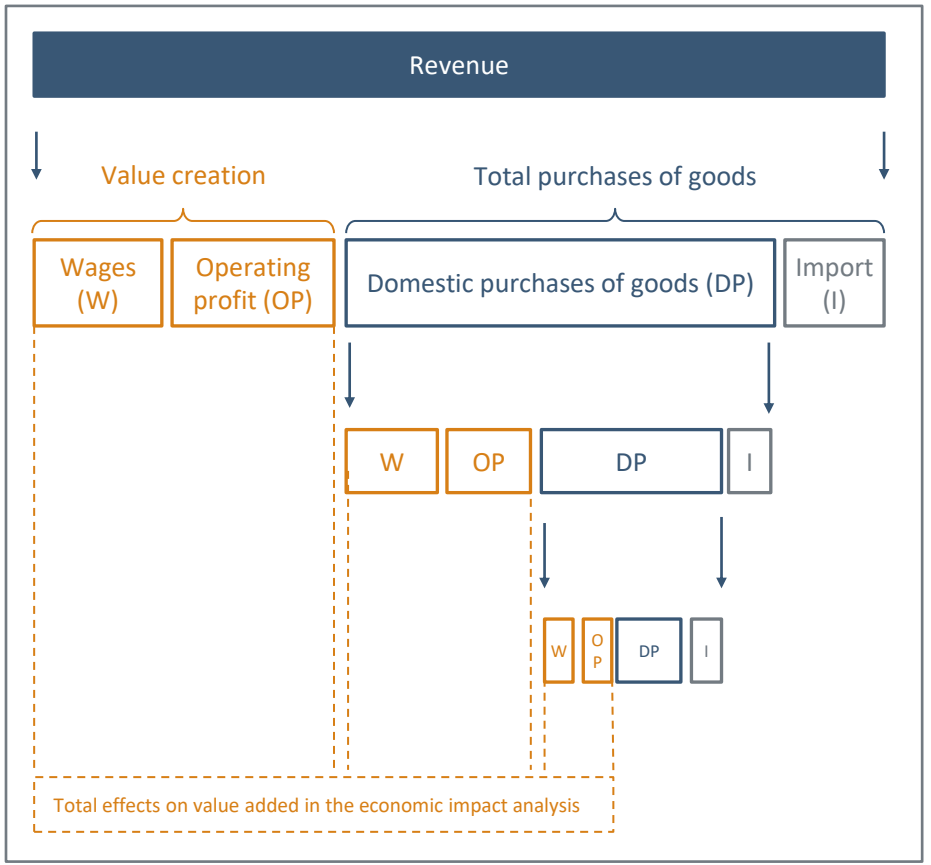
On the next two slides, we provide a brief introduction to economic impact analyses.

The establishment of large data centres such as the one in Hamar has major effects on the demand for a wide range of products and services from different industries. In the first instance, a contractor will demand materials from the building and construction industry, as well as services from the likes of engineers and architects.

The investments will therefore lead to increased production by both the main contractor as well as its subcontractors. The investments will thus support both value creation and employment at these companies along the value chain.

For each company in the entire value chain, we can divide total revenue into four different categories: Domestic purchases of goods, foreign purchases of goods, operating profit and labour costs. The sum of the latter two constitutes what is called value added (also known as "contribution to GDP"). To calculate the total economic impact, one uses the fact that domestic purchases of goods constitute revenue for the companies in the next stage of the value chain.

The figure on the right shows a sketch of how an investment has an impact far down the value chain. The sum of the orange boxes at all stages constitutes the total effects on value added.



Economic impact analysis – an introduction

The model

Changes in demand from either an industry or as a result of a project or an infrastructure investment will affect Norwegian economic activity and tax revenue. We model these effects by calculating the size of the investment and operating costs and their effects on employment based on Statistics Norway's input-output tables.

Statistics Norway's input-output tables show the extent of deliveries, employment, taxes and duties, as well as imports and exports in 64 NACE industries. This forms the basis of our model. The calculations start by placing the total costs of the investment into the relevant industry categories to which they belong. In order to produce the goods and services that the companies produce, they buy goods and services from other companies in Norway and abroad. Statistics Norway's input-output tables show average imports from each industry, as well as an overview of deliveries between the 64 different industries in the statistics. Based on this, we calculate the employment effects backward in the value chain. For each link in the value chain, the employment effect becomes smaller.

It is important to note that an economic impact analysis is a so-called “gross effect analysis”. Gross value creation is higher than net value creation. Gross value creation includes the value creation resulting from the activity induced by the reallocation of capital or labor, but it does not say anything about the alternative use of either two resources. In the event of a shortage of labor, part of the employment effects from an economic impact analysis will be taken from other industries and areas, and thus will not lead to an increase in overall Norwegian employment. The low unemployment in the region we showed earlier suggests that the net effects for this data centre will most likely be smaller than the gross effects.

Assumption

The total investment for building the five data centre buildings is around NOK 29 billion. It takes 15 months (12 months to build and 3 months to install equipment) to complete one building, and the start date of the individual data centres is four months apart. In total this results in a construction time of about 2 years.

The investments are split up in different cost categories. The largest cost category is the equipment that the client buys to fit out the data centre which makes up about NOK 14 billion. Furthermore, the installation services and the pods, generators and chillers make up about NOK 11 billion.

One key assumption in an economic impact study is the import share, and local content. The total import share for the full investment phase is estimated at around 60 percent of the total investment. This is mainly due to the fact that large cost categories, such as servers and equipment, will be imported from abroad. In total, we estimate that of the NOK 29 billion, about **NOK 11.3 billion will be supplied by Norwegian companies**.

For the operational phase, we have calibrated the model using data from both Green Mountain, its main contractors and the international client. These data both include the suggested number of FTEs at the data centre and the projected cost base (which lay the foundation for employment further down the value chain). These data however are anonymised and will not be presented here.

We have not received any detailed data on the chosen suppliers in either the construction or the operational phase. This means that we have had to estimate the geographical distribution of the employment effects using Menon’s economic impact model, ITEM.

Operations – employment effects

The total **economic impact of the operations is estimated at around 300 FTEs annually**. The employees are distributed between direct effects, indirect effects in the region (Innlandet) and indirect effects in the rest of Norway. These are shown in the graph to the right.

The direct effects of the operations include all employees working at the data centre. This includes around 20-40 FTEs employed by Green Mountain, 50-100 FTEs employed by the client, while the rest will be long-term service providers, but for whom the data centre is their main place of employment. In total the direct effects of all the data centres amount to 225 employees.

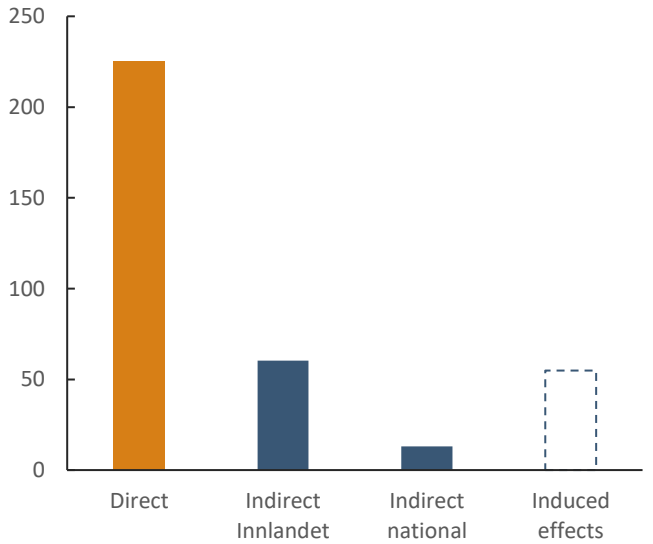
During the operational phase, the data centre will require a diversified labour force with skilled workers with backgrounds in electrical, mechanical, automation, IT and data electronics, among other fields. Additionally, there will be positions related to project management, security, cleaning, as well as various support functions.

The indirect effects in the county of Innlandet cover all employees who work in companies that supply goods and services to the data centre, but who work elsewhere. This post also includes all subcontractors further down the value chain. In total this makes up approximately 60 additional employees in Innlandet.

The operation of the data centres also lays the foundation for roughly 15 more employees in the rest of Norway.

As people working in and around the data centre spend their wages on goods and services, they will support employment in adjacent sectors. We call these effects induced effects. In total, we estimate the total consumption effects to be around 55 employees.

Total employment effects from operations. Source: Menon Economics



Operations – contribution to GDP

In addition to employment, the activity in and around the data centre also contributes to Norway's GDP. We estimate the **total annual economic impact of the operational phase to be roughly NOK 260 million.** This includes value creation both in the data centre, but also value creation elsewhere in the value chain. The distribution between the value creation in the data centre and the value creation through its suppliers is shown in the figure to the left.

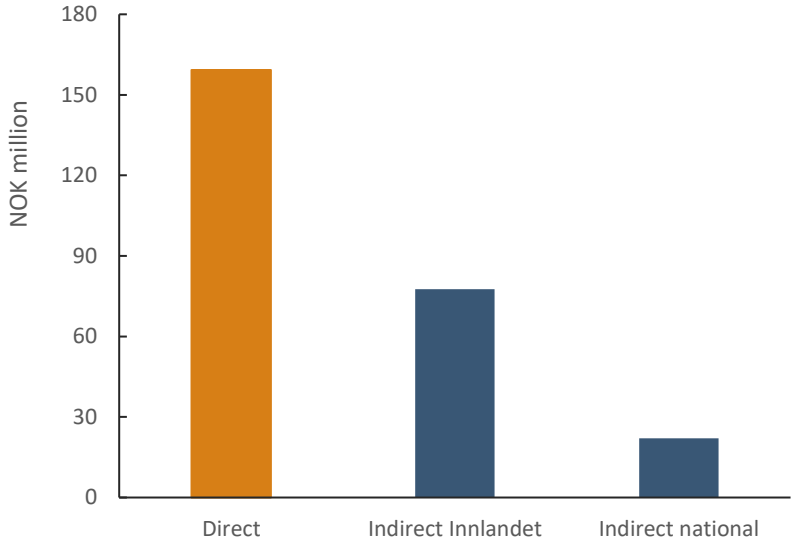
The direct effects are defined as on the previous slide, meaning that they consist of all people working at the data centre. In total the direct contribution to GDP of the data centre amounts to NOK 160 million annually.

The indirect effects in Innlandet include all the value creation that the data centre supports through the purchase of goods and services. In total this makes up about an additional NOK 77 million in Innlandet every year.

The operation of the data centre also lays the foundation for a value creation of roughly NOK 22 million in other parts of Norway.

In addition, the data centre in Heggvin will also have an economic impact through its demand for electricity. We estimate this to be roughly NOK 450 million annually. This is calculated using the cost of long-term electricity price multiplied by the average value-added as a share of revenue in Norwegian electricity providers.

Annual contribution to GDP from operations. Source: Menon Economics



Construction – employment effects and contribution to GDP

The construction of the data centre supports 8,300 FTEs over the construction phase.

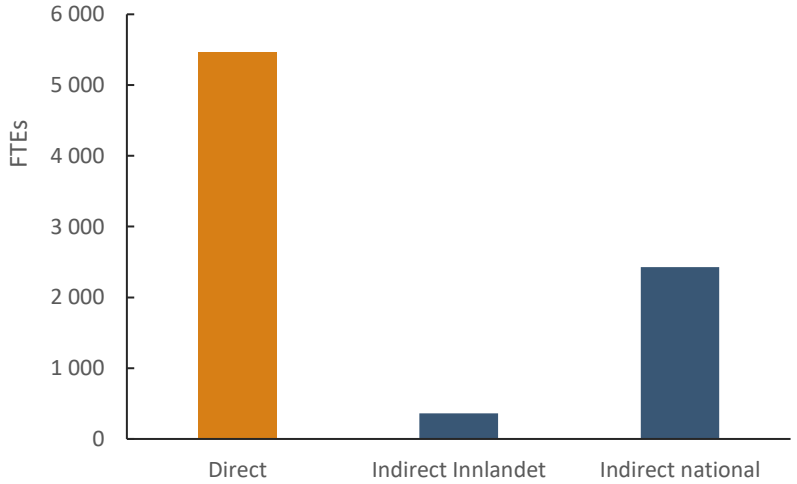
The direct effects of the construction are estimated to around 5,500 FTEs. This includes all effects from the direct purchases in the investment phase by either Green Mountain, the main contractor or the client. When it comes to people working at the physical construction site, the contractor estimates that there will be an average of 400 FTEs over the construction period.

The indirect effects of the construction include all other employment effects elsewhere in the value chain. We estimate that the total indirect effects amount to 2,800 FTEs. Of these, our model suggests that roughly 350 FTEs will be employed in Innlandet, while the remaining 2,450 FTEs will be employed in other parts of Norway.

In addition to employment effects, the activity in the construction phase will also contribute to Norwegian GDP. We estimate that the total contribution over the entire period will be around NOK 9 billion.

One important difference between the construction phase and the operation phase is that the construction phase is temporary, so all effects related to construction will take place between 2022 and 2025.

Total employment effects in the construction phase. Source: Menon Economics



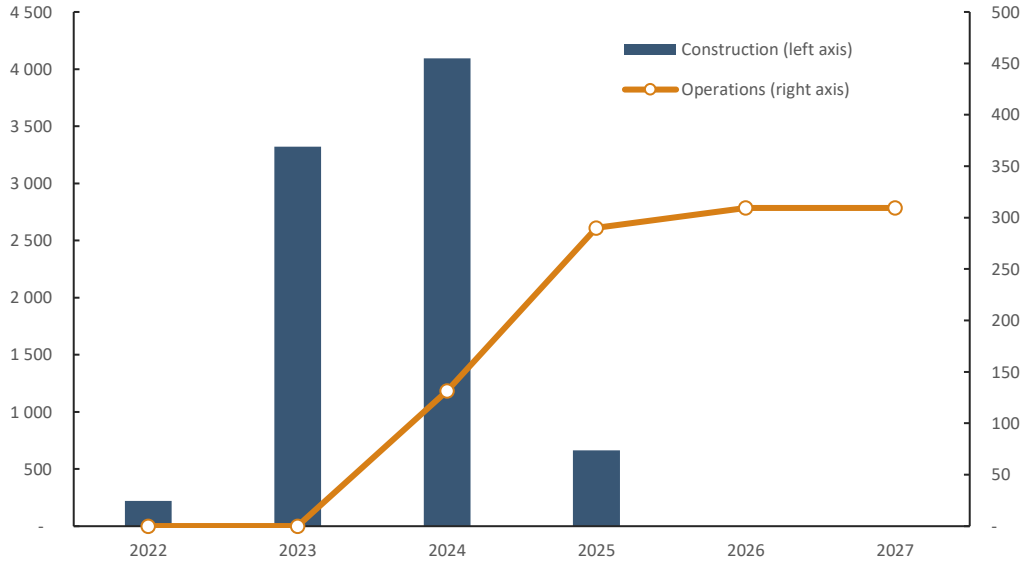
Temporal distribution of the employment effects

The total economic impact measured in employees resulting from the full process of building and operating five data centres is around 8,300 employees in the construction phase and around 300 employees in the operations phase. The temporal distribution of the employment effects is shown in the figure to the right.

As stated earlier, the buildings are expected to take around 15 months (12 months to build and 3 months to install equipment) to complete, and the construction of the individual buildings will start at approximately four month intervals. Consequently, we see that the employment effects from the construction phase (the blue bars, measured on the left axis) increase continuously already started (in the end of) 2022. In 2023 and 2024, the effects from the construction phase will increase significantly and will be 3,300 and 4,100 FTEs respectively. In 2025, the effects will fall significantly, as the last buildings are finished.

However, this decline will be somewhat countered by an increase in the employment effect from operations. These effects are fairly small during the beginning of the construction phase, but will increase from the beginning of 2024, when the first building will be operational. From here, they will rise until they reach a level of roughly 300 FTEs annually. It is important to notice that while the effects from operations are much smaller than those from the construction phase, they will be lasting, and are thus more likely to create new jobs in the region.

Total *annualised* employment effects of the **construction phase** over time. Quarterly. Source: Menon Economics



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Potential applications of the waste heat produced from the data centre

ECONOMIC IMPACT ANALYSIS

The concept of waste heat

Storing and processing large amounts of data requires significant amounts of energy, and a large portion of this energy ends up as waste heat. Waste heat is thermal energy in the form of hot air, water, steam or exhaust gas with a higher temperature than the surroundings, and which is not utilized for the primary purpose of the facility.[1]

In industry, waste heat has traditionally been used internally in companies for power generation or process heat. The heat has also been sold to district heating companies, but there is limited infrastructure for district heating in many places where excess heat is available from industry.

Although this is a resource that represents potentially large values, its use has for many years been limited. Yet, in recent years this has seemed to change, mainly due to a strong global focus on climate and environmental challenges and the need for green transformation.

Data centres typically have very stable operation throughout the year, with corresponding consistent power consumption. This means that the waste heat generated from these facilities is also produced evenly throughout the year. This is considered an advantage for recipients who have continuous stable demand, preferably in the form of low-temperature process heat. Utilisation of this heat can lead to significant environmental and economic benefits, which we will examine more closely on the next page.

1) NVE (2020). Kartlegging og vurdering av potensial for effektivisering av oppvarming og kjøling i Norge. Nr. 8/2020

Potential applications of waste heat

During operation, the data centre at Heggvin will have an annual power consumption of around 0.8 TWh. Assuming 80-90 percent[1] of this ends up as waste heat, that amounts to a total of 640-720 GWh annually (ca. 10 percent of the total amount of district heat produced in Norway in 2019)[2]. This is an upper limit and the amount of energy that can actually be utilized depends on several factors. A study from 2021 indicates that the utilization rate varies from 20 to 80 percent for different types of industry.[3]

For Green Mountain and its client, the waste heat has marginal value in isolation, but for other businesses, it could be a fully-fledged substitute for electricity, at a lower cost. To realise the values that lie in this waste heat, it is essential that local and regional actors collaborate and search for creative initiatives. As no agreements for the usage of the waste heat have been entered into yet, solutions must be found that can help build necessary infrastructure in a cost-effective way.

Internationally, we see that several large data centres have begun to utilise waste heat to a much greater extent than previously seen. This suggests that there are good opportunities to use the waste heat that will be generated at the data centre in Hamar for heating or other industries. On the right, we have illustrated some of the areas that could be of interest.

The waste heat produced from this data centre will come in the form of heated water with a temperature of 24-25 degrees Celsius. This is relatively low, and thus it will not be suitable for all the applications in our example, but the important message here is that there is a huge amount of waste heat available.

Green Mountain will facilitate the infrastructure on the industrial site and create connection points there, but further infrastructure will require further initiatives and more users to be economically viable. The more the cost of the infrastructure can be shared, the less of a hindrance it becomes to realising the potential and value that lie here.

Examples of different types of industry that potentially could utilize waste heat from a data centre

Industrial processes

District heating

Agriculture

Biogas

Land-based aquaculture

1) Norsk Energi (2021). Smart bruk av spillvarme og grønn næringsutvikling. Konseptutredning Ringerike kommune and Thema Consulting Group (2020). Datasenter på Jæren – virkninger for klima, miljø og regional næringsutvikling.
2) https://www.ssb.no/energi-og-industri/artikler-og-publikasjoner/stadig-mer-bruk-av-fjernvarme
3) Norsk Energi (2021). Smart bruk av spillvarme og grønn næringsutvikling. Konseptutredning Ringerike kommune and Thema Consulting Group (2020). Datasenter på Jæren – virkninger for klima, miljø og regional næringsutvikling.

Potential value of waste heat

We have shown that the waste heat generated by the data centre represents a large amount of energy. In the following, we estimate the monetary value of that energy.

The waste heat generated by the data centre is expected to lie within the range of 640-720 GWh annually and given an interval of 20-80 percent utilization rate, the actual amount of energy realized could be in the range of 128-576 GWh.

If the waste heat was a perfect substitute for electricity, the value would be in the range of 100-460 million NOK annually (assuming a price of 800 NOK/MWh[1]). But this is not the case given the fact that most users would need to account for the costs associated with a different infrastructure and installations to be able to utilize the waste heat.

Still, the general point remains. Given the fact that the waste heat has a marginal value to Green Mountain in itself and represents a monetary value of up to several hundred million NOK annually, we encourage the industry in the whole of the Hamar region and the municipalities to come together and try to find ways to realize this value.

In addition to its financial value, utilising waste heat for district heating or electricity generation can help reduce greenhouse gas emissions by reducing the need for fossil fuels. For every kWh that could be replaced with waste heat, the grid will be relieved accordingly. Offloading the network contributes to better resource utilisation and reduced investments in infrastructure. Therefore, there is a significant opportunity for companies to not only generate revenue but also contribute to reducing carbon emissions by utilizing the waste heat generated by their data centres.

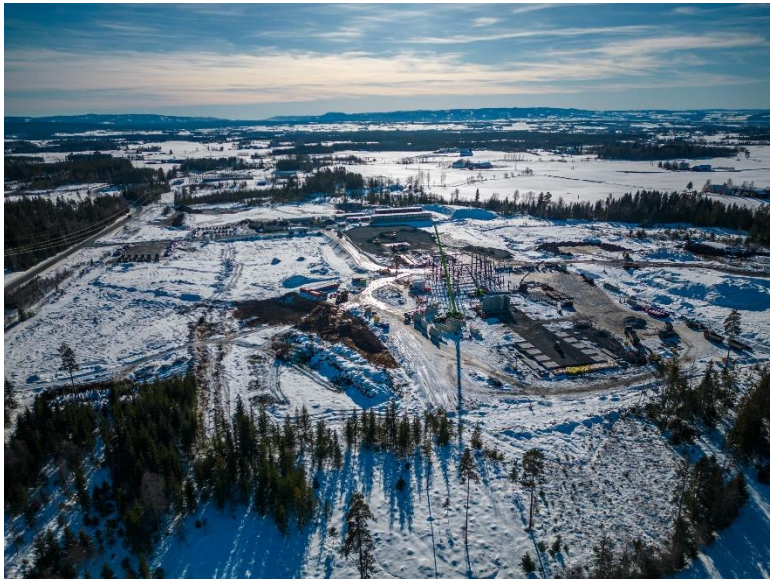

Foto: Green Mountain

1) https://www.nordpoolgroup.com/en/Market-data1/Dayahead/Area-Prices/NO/Daily1/?dd=NO1&view=table, https://www.fjordkraft.no/pressemeldinger/langsiktige-fastprisavtaler-til-naringslivet-er-klare/
2) This corresponds to both the long-term contract prices as well as the average price in NO1 electricity area over the last five years.

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ECONOMIC IMPACT ANALYSIS OF A NEW DATA CENTRE IN HAMAR