Stavanger, 19'th april, 2025

Iceland hearing of the frame plan for ten wind power projects

Iceland is currently considering several applications for the building of new wind farms. Here, I would like to share some insights we have made in Norway in the hope that it will be helpful for you to understand the implications this will have on Iceland, including your nature and biodiversity – arguably Iceland's most valuable assets.

Bjerkreim wind farm in Norway. The picture shows the dramatic impact the development of a wind farm has on the surrounding nature.

In recent years, six hundred square kilometers of nature, equal to 84.000 soccer fields, have been lost to the wind industry in Norway. Nearly all of it being wilderness areas in mountains and forests. Most of these were popular recreational areas, beloved by the local people. Additionally, many areas provided shelter for rarely sighted and endangered species, such as the great horned owl. It has taken the Norwegian public nearly 20 years to understand the detrimental effects wind farms pose to our fragile natural ecosystems. But today the public has awoken and understands that building new wind farms means that untouched nature is being forever altered. Today we have 65 wind farms in Norway and the majority of Norwegians are against more being built.

A question of values

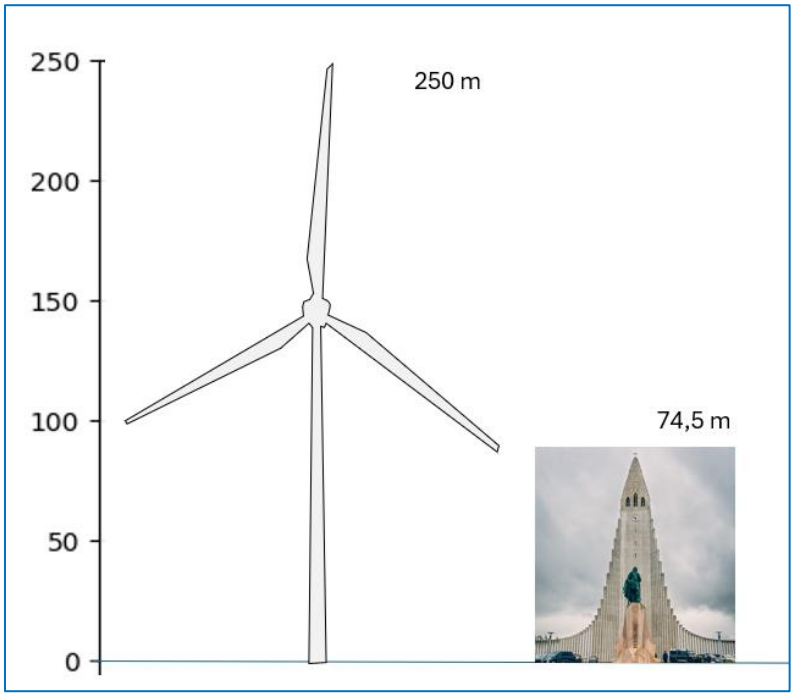
Nothing is free in the world we live in - not even the wind, if we want to monetize it. Wind farms come with many costs, harm, destruction and disadvantages. In Norway these detrimental factors has for many years been systematically ignored and minimized as insignificant by those who wanted to make money by acquiring permits for wind farms.

Once you are aware of these negative factors the question of building a wind farm changes from being a, seemingly easy, question of monetizing "free wind" to a question of what values you as an individual, and as a nation, will prioritize. A wind farm in your neighborhood will have a huge impact on your countryside and your connection to the nature where you live. Also, many species which have their homes in these areas may no longer find it habitable. Evidence also shows that people's health and quality of life may be impacted, and often severely. On the other side of the scales lies the question of money, where normally only a few will benefit financially from new wind farms being built.

The question of values boils down to: Will Iceland want to keep its nature intact, or will it put it up for sale? Will you follow the money and sacrifice large wilderness areas so that a few can profit from it?

Size of wind turbines

In Norway the size of the wind turbines has grown substantially over the last years. The first big suite of wind turbines installed in Norway was 80 to 130 m tall. Many concessions were granted when the public thought they would be like the small turbines they saw when driving around Denmark. When the wind farms were built, up to 10 years after the permit was granted, the normal size of a wind turbine had increased to 150 to 190 m. It came as a huge shock to many when they realized the actual size and the visual impact it would have on their landscapes. Today, the average size of wind turbines included in applications for new wind farms in Norway is 250 m with the tallest turbine currently applied for at 285 meters. You may see similar sizes in Iceland.



Hallgrimskirkja compared to a 250 m tall wind turbine.

When people's opinions on wind power were surveyed in the early days most people replied that they were not very concerned about size. When the turbines were built this view changed drastically. It is likely this was due to most people not having a frame of reference on size. It is difficult to worry about something that one does not know much about. Based on the questionnaire responses presented in the hearing documents, indications are that Iceland may be at the same stage in the process as Norway was in the early days.

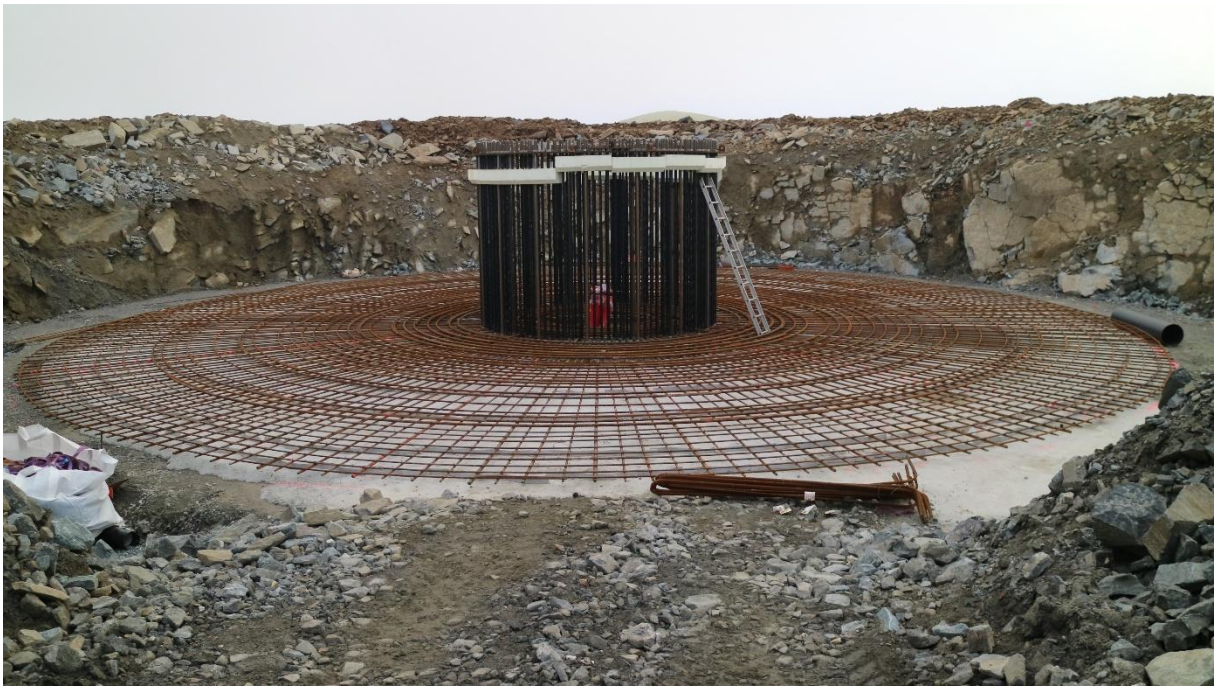
Destruction of nature

It is obvious that transporting large and heavy equipment into mountain landscapes to erect 250 m, or 200 m, high wind turbines will require building of wide and invasive roads. This will have a strong impact on, and create huge scars, in Iceland's landscapes. It will take thousands of years to erase these scars and return it to the state that Iceland's nature is in today.

In Norway most wind turbines erected in mountains will normally be anchored by drilling a circle of holes into the bedrock and fastening long bolts into the holes. The wind turbine tower is then fastened onto these bolts. These holes can be anywhere from 9 to 30 m deep depending on the quality of bedrock. In Iceland the bedrock is soft, inhomogeneous and layered volcanic rocks. In most places this type of bedrock will be unfit to safely anchor tall wind turbine towers directly into the rocks. It will therefore be necessary to build gravity foundations (see pictures below). This means digging and blasting a deep and wide hole into your bedrock and building a huge steel reinforced concrete base for the turbines. This will add to the destruction of Iceland's nature. In the future, when wind farm have come to the end of their life cycle, it will be almost impossible to remove these concrete foundations as it will be too expensive. Nor can new wind turbines be built upon the same foundations as they will not fit. The foundations will be buried, like in Norway, and remain temporarily hidden until time and erosion exposes them – appearing again like ugly concrete mounds with rusting bolts on top, scattered across your landscape. This may take anywhere from a hundred to several thousand years, but it will happen. These mounds will be nasty "gifts" left for future generations to deal with.

Stavanger, 19’th april, 2025

Okla wind farm, on a mountain in western Norway. Here even the Norwegian bedrock was too fractured for safely anchoring wind turbines into it, so gravity foundations had to be built. This mound shows mass excavated just to anchor one 150 m tall wind turbine.



Okla wind farm. Basal part of a gravity-foundation which, when completed, will require a lot more reinforcement with steel and concrete. The concrete will reach nearly to the top of the long bolts protruding in the middle of the foundation. These concrete blocks will be extremely expensive to remove after the wind turbine is disassembled.

These steel reinforced concrete foundations will remain in nature as an ugly reminder of our ill-advised mistakes.

Visibility and flashing lights

Wind farms are normally built on top of mountains. They will thus become visible across large distances and may dominate the landscapes up to 30 km away. People who live with wind turbines in the view form their living room windows say that the constantly moving wings are a huge distraction – like having the TV on while entertaining guests.

EU and international air traffic regulations require flashing lights to be put on top of most wind turbines in a wind farm. If the wind turbines are higher than 150 m the lights are required to flash 24/7 – day and night. Many people find these flashing lights highly annoying at night.

Adverse impacts on Tourism

The impact of visible wind turbines on tourist destinations is normally underestimated. Tourists from abroad come to Norway and Iceland to experience pristine and spectacular nature. Tourists will not go to Iceland to see wind turbines. Iceland is highly attractive as a tourist destination because of its untouched and stunning nature.

There is little doubt that having a lot of wind farms visible from tourist destinations will negatively impact Iceland's tourism industry

A Swedish study found that visible wind turbines significantly reduce the attractiveness of a tourist destination. The study found that 67 % of Swedes and 81 % of foreigners views the presence of ten to twelve 150 m high wind turbines as negative for the experience of the landscape.

Sweden: Tourists opinion on wind farms in mountain landscapes

¤	Mycket·negativt·¤		Negativt¤		Neutralt¤		Positivt¤		Mycket·positivt·¤	
¤	S¤	U¤	S¤	U¤	S¤	U¤	S¤	U¤	S¤	U¤
1-2·verk·20m·höga¤	17¤	29¤	22¤	22¤	38¤	38¤	15¤	10¤	7¤	2¤
2-6·verk·50·m·höga¤	30¤	38¤	23¤	31¤	30¤	27¤	11¤	3¤	6¤	0¤
10-12·verk·150·m·höga¤	42¤	54¤	25¤	27¤	22¤	16¤	7¤	3¤	5¤	0¤

Question: How would you as a tourist experience a visual change of the landscape with development of wind farms within view from your destination?

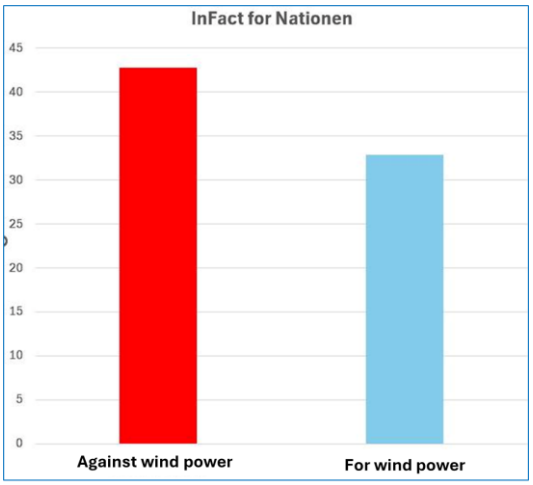
Bosse Bodén, Mittuniversitetet

Take for example, the well-known "FlyOver Iceland" experience and consider what Iceland's natural landscapes would look like with wind turbines littered across the mountains. It is an easy guess that the winners in future tourism will be places where citizens have actively preserved their country's natural beauty from human development. Tourists normally vote on such matters with their feet, and you may never know what happened when the flow of tourists, and associated income, starts falling.

Nature and recreation

In Norway most people value nature highly and appreciate the recreational value of untouched landscapes. I understand that many Icelanders also have love for their nature.

The love of nature is one of the main reasons why public attitude towards wind farms have swung from only 20 % being against wind farms in 2014 to the majority of the population being against wind farms today. When people saw, and experienced it for themselves, how wind farms altered their beloved nature and recreation areas, their views changed. They realized that hiking in soulless and noisy industry landscapes brings little recreation and respite from daily stress.

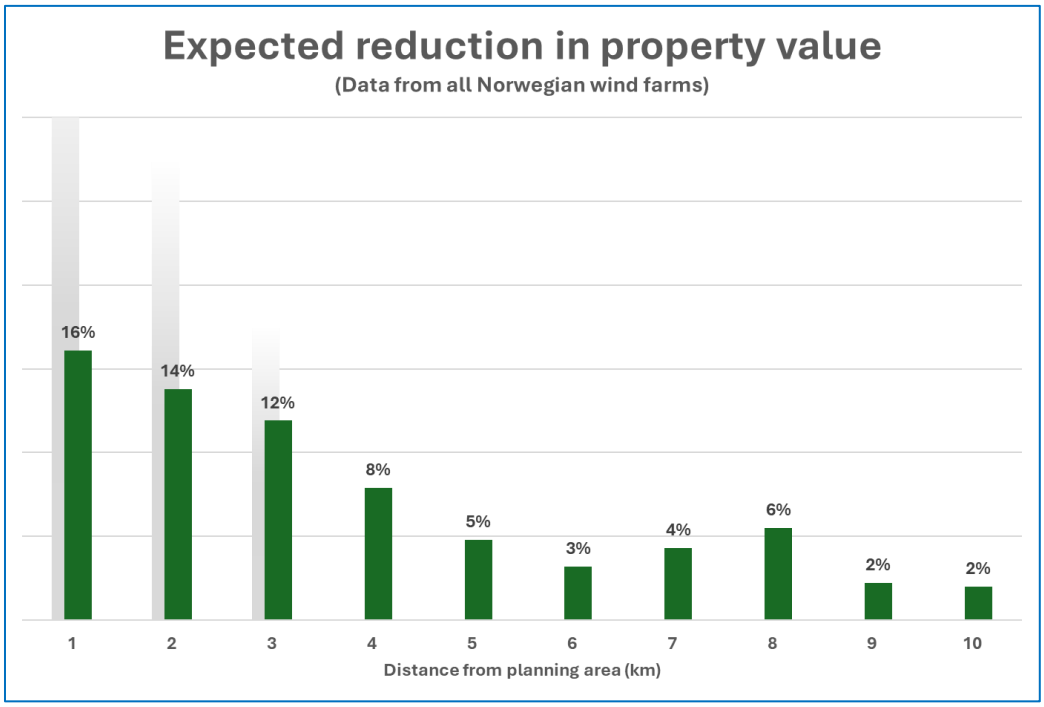


InFact opinion poll on wind turbines, July 2024: Only 33 % of the population is for wind power in their own municipality.

Loss of property value

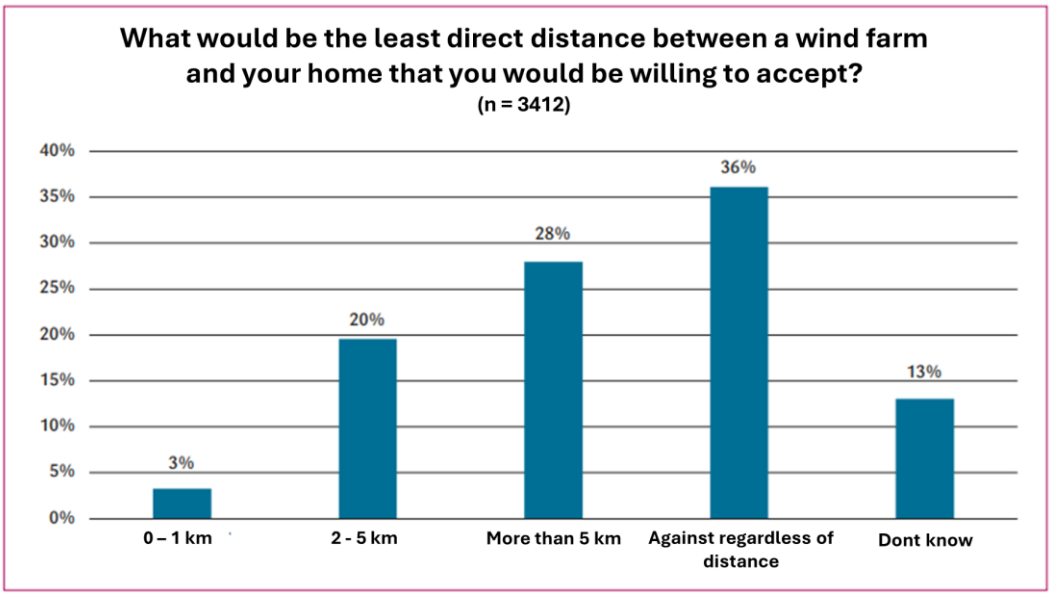
According to a Norwegian study of impact on property values from wind farms in Norway «Effekter av landbasert vindkraft på boligpriser i Norge» (Menon Economics and SSB) property values will be reduced for homes up to 10 km away from wind farms. This conclusion is further supported by two Swedish studies «The Socio-Economic Cost of Wind Turbines: A Swedish Case Study» (MDPI, 2021) and «Valuating the negative externality of wind turbines» (Diva, 2022) carried out by researchers at Sweden's Royal Institute of Technology.

This drop in property value is money that is transferred from the neighbors to the wind farm owner.



Data from the Norwegian study shows the reduction of property value. (Graphics: Kaare Finbak)

This should not come as a surprise to anyone. A survey of opinions of people on how close they would accept living to a wind farm showed that only 28 % were willing to live near a wind farm, even if the distance was more than 5 kilometer *(Samfunnsøkonomen nr. 5, 2022)*.



Windpower brings no jobs

Stavanger, 19'th april, 2025

During the permitting process for wind farms many promises have been given about the "numerous goods" that the wind farms would bring. A common promise was that it would bring many local jobs and new industry. But, like most promises made by the wind farm salesmen in the intense phase of seeking the permit, they did not materialize.

Constructing a wind farm is a highly skilled project. It requires a lot of knowledge and machine capacity to deliver the wind farm ready in time at the appropriate specifications and cost. Only a few companies in Norway can do this.

When the wind farm company Zephyr built a wind farm in the municipalities of Kinn and Bremanger, a boat full of lorries and excavators arrived from 400 km south in Norway. Only a limited amount of the construction contracts was awarded to local companies. Furthermore, the assembly of the wind turbines in Norway have mostly been carried out by cheap east European laborers, sometimes grossly underpaid. Cost cutting by using cheap labor has been the norm.

The permanent jobs are also few and far between, ranging from one to six, maybe eight, local jobs for the biggest wind farms. On average the investment required to create one single permanent local job has been in the order of 20 – 30 million Euro, or more, for the newer wind farms.

Noise and health

Wind farms are the largest manmade sources of noise that society may construct. A large portion of people living within 2 km from the wind turbines report annoying noise. Such reports are also common out to 3 km from the 150 m tall turbines currently deployed today. We do not know enough about how far the noise will travel for 250 m wind turbines, but we can be sure it will carry even further out.

Topography greatly impacts the distance at which noise travels. In Norway we have cases where people report annoying noise at distances up to 7 km from 200 m tall wind turbines where topography and local weather conditions favors sound transmission.

A health study at the Tysvær wind farm reported that 40 % of the neighbors wanted to move away from their homes due to the environmental burdens from the wind farm. 40 % of all permanent residents within 2 km from the wind farm were subjected to annoying noise which can lead to health problems. Reduced and low-quality sleep was reported as the biggest problem, but impaired concentration was also noted by several respondents. The sum-total result is reduced life quality and health for many wind farm neighbors. (According to the WHO report *"Burden of disease from environmental noise"* annoyance is a key factor in breaking down health).

It may be interesting to note that the municipality conducted this study only after several years of intense pressure from desperate residents who were suffering from the noise.

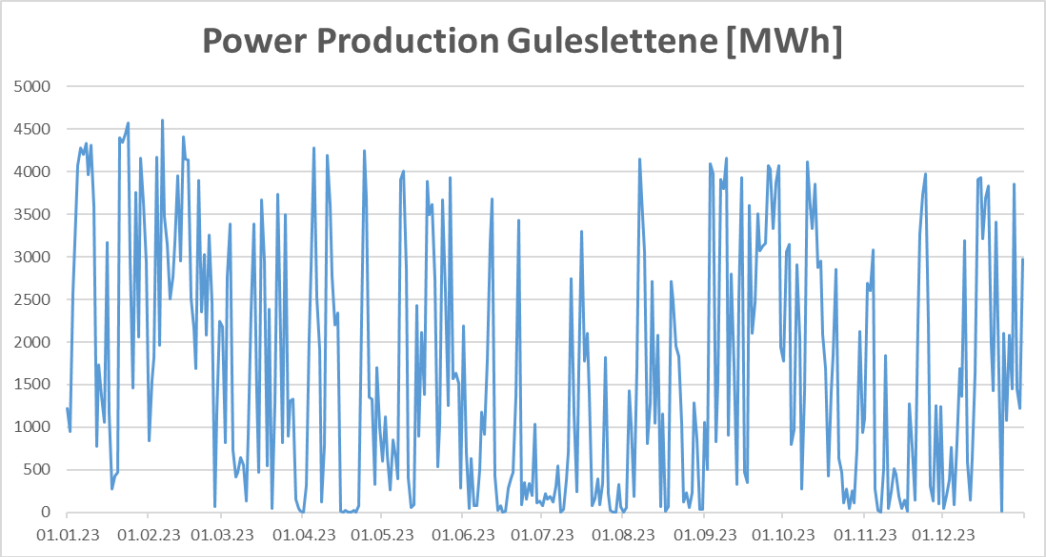
Stavanger, 19'th april, 2025

Electricity prices and cost

It is a common misunderstanding that wind power will bring lower electricity costs. There is no empirical evidence from countries with a lot of wind power which shows that the cost of power will go down in parallel with the amount of wind power. On the contrary the costs will increase significantly. There are several reasons for this, among others:

In Norway the development of wind power requires a significant expansion of new high voltage power grid to transport the power to where it will be used – mostly to EU. The power users must pay for this cost which is allocated regionally. While industry gets favorable terms, the private user pays the bulk of the cost in the form of a grid rent which will rise significantly due to the increased cost of the new power grid for the wind farms.

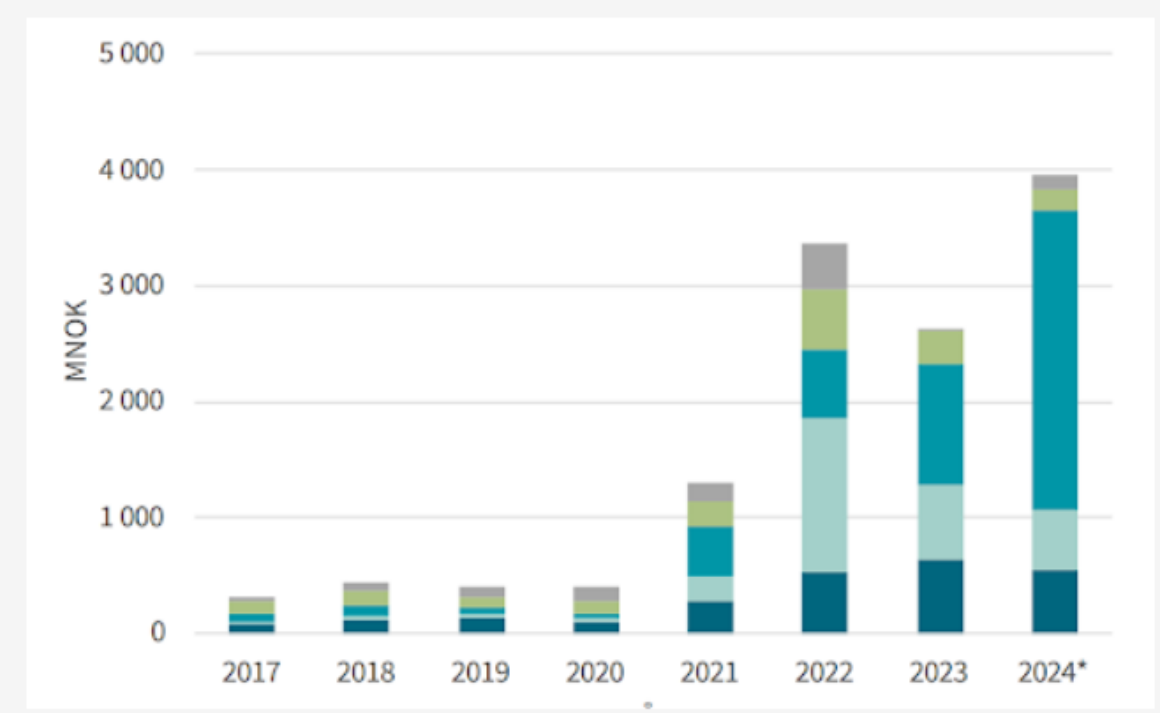
Wind is an unpredictable and unstable power source. For wind power to be usable in a power system it will always require an additional controllable power source which can be quickly adjusted to balance out the peaks and lows of wind power to stabilize it. This is essential as small variations in frequency outside of the acceptable system limits can cause significant damage to highly expensive electronic industrial equipment connected to the power system. Over the next years Norway will invest 50 billion NOK to upgrade the hydroelectric power system. Very little new power will be produced as the upgrades are mainly focused on upgrading effect in the power system to be able to balance the rapid changes in power from wind- and solar power in Norway and in EU. Someone will have to pay for this – and again it is the Norwegian power users!



This chart shows the rapid and frequent variations in power production from the Guleslettene wind farm in Norway. The unstable power supply needs to be properly balanced at all times to be able to feed the power from a windfarm into the national grid.

From 2019 to 2021 a lot of wind power became operational in Norway. Production increased approximately 10 %. This unstable power has had a drastic impact on the

system operational costs in Norway's power grid. The consumers pay for these extra costs through the grid fee.



Increased system operational costs in Norway power grid. Source NVE

In Germany it is mainly gas and some coal power that provides this balancing function. But these energy sources cannot provide complete support and a separate balancing system which entails keeping very significant rotational masses permanently rotating to absorb and compensate for instantaneous variations (seconds to milliseconds) from the wind turbines. In Norway hydropower and the inertia from the large rotational masses in the water turbines and their generators provide this instantaneous balancing function.

The only type of hydropower which can always be available to deliver this system service is hydropower from dams. Hydropower from rivers, where water cannot be stored, and therefore will not always be available, cannot provide this system service. A key question Iceland needs to address will therefore be how much wind power the country's current power system can handle?

With a significant amount of wind power in Iceland's power system it may require a lot of extra investment to always provide the required backup for balancing-power which needs to always be available. Someone will need to pay for this.

Long list of issues with wind power

The list of issues and negative environmental consequences is long. We could talk about killing birds, forcing birds and animals out of their natural habitats, pollution of nature, inability to recycle the used wind turbine epoxy blades, the enormous demand for metals and minerals for which the mining in turn will damage nature, the large conflicts

it creates and many other problems. Wind farms generate a lot of negative effects which all must be solved, or ignored, at great cost to people, biodiversity, nature, environment and economics.

And then, the solutions we choose to solve the problems may in turn cause new problems which also must be solved. An example of this is when hydropower is used to balance wind power the flow of the Norwegian rivers downstream of the hydropower plants will change from full flow to almost dry when the water is held back. This creates problems for salmon and trout which must then also be solved.

Nuclear power

Nuclear power is taking the world by storm these days. Google is ordering at least six SMR (Small Modular Reactors) to be deployed around 2030. Microsoft is reviving an old nuclear facility at Three Mile Island in the US. Globally the world's biggest banks pledge support for nuclear power with financial institutions including BofA, Morgan Stanley and Goldman backing the COP28 climate goal of tripling capacity by 2050. With so much money being committed to nuclear power, it is going to make great progress. New technology will be established and cost will go down as mass production takes hold.

Nuclear power has several advantages over wind power. It requires little space, approximately a football ground, it creates many well-paid jobs, nuclear power plants can last for 80 years or more. Perhaps, most importantly, it will always be a well-regulated and closely monitored industry. Nuclear energy will not lend itself to the wild and uncontrolled cowboy mentality that currently rules wind farm activities in Norway and elsewhere.

In Norway nuclear power has become the biggest worry for the wind farm industry as it will soon replace the need for occupying vast areas of nature to build wind farms.

Outlook on the future of wind power

Wind power is an unreliable energy source for producing energy and has many disadvantages. Wind power is therefore likely to have a short future lifespan as current problems will become increasingly visible, driving up the all-in costs. Nuclear energy is likely to replace wind power on a worldwide basis.

Wind power is likely to become a bubble in energy history because it does not have the capability to become anything but an illusory solution to the climate crisis. If Iceland goes ahead with building wind farms, it will be left with irreparable damage to its nature. It is a poor trade for just a few years of energy production before nuclear takes over.

The fundamental question

Stavanger, 19'th april, 2025

What values will Iceland want to base its future on? And, on a personal level, in what state will you as citizens of Iceland want to pass your country on to your children and coming generations?

If you go ahead and build a lot of wind farms those who come after you may curse you for what you have done to your country. They will surely do so in Norway where we have already destroyed and scarred 600 square kilometers of untouched mountain and forest nature.

Recommendations

Iceland has already had some unpleasant experiences with a past "economic bubble". I have, in the above, discussed several factors which may lead one to recognize that wind farms are also a bubble. It may be worth asking yourselves if you want to take a pass on this one.

If Iceland should believe that the country needs more electric power, then I would recommend that you consider nuclear power, or other alternatives. In Norway, pre-permit applications for nuclear power plants are already under evaluation.

I wish Iceland the very best for its future and hope that your country will remain as beautiful and inspiring as it has been the times I have visited.

Sveinulf Vågene,

Geologist - and energy-adviser at Motvind Norge
13 years of experience with wind farms
Mail: svagene10@gmail.com