Speech

Climate Change and Monetary Policy

Lecture by Governor Ida Wolden Bache at NHH – Norwegian School of Economics on 7 October 2025.

Introduction

Thank you, Helge, for that kind introduction! It is a great pleasure to be here at NHH – Norwegian School of Economics. And since I know you like to divide people into two groups, those who walk on escalators and those who don't, I can assure you that I did not stand still on the escalator at Flesland Airport when we arrived here in Bergen yesterday!

The world has also not been standing still in recent years. The pandemic, Russia's invasion of Ukraine and global trade uncertainty have caused large movements in the economy and financial markets. We have been reminded that inflation can rise rapidly when high demand and significant supply-side shocks interact. When inflation surged in 2022, we raised the policy rate sharply and rapidly, and only this year have we started a cautious easing of monetary policy. However, the job of tackling high inflation has not been fully completed. From our current standpoint, we do not envisage a large decline in the policy rate ahead.

However, history has shown us that the policy rate may turn out to be higher or lower than currently projected. We must be prepared for economic prospects to change due to structural changes and new unexpected events. The security policy landscape is changing. Technology is developing rapidly. The population is ageing, and governments in many countries are weighed down by high debt. At the same time, global warming continues.

Curbing global warming is one of the greatest challenges of our time. 2024 was the hottest year since systematic measurements began. More intense storm rainfall, flooding and drought remind us that cutting greenhouse gas emissions is urgent.

Chart: *Climate change and transition*

This brings me to the topic of my speech today, which is what climate change and the transition to a low-carbon economy might mean for monetary policy – and what monetary policy might mean for this transition.

To address these questions, we first need to discuss how climate change affects the economy and the variables relevant to policy rate setting.

Economic effects of energy transition

It is then helpful to distinguish between climate changes in themselves and the changes resulting from the transition to a low-carbon economy.

Let us start with the transition. A successful transition requires largely replacing fossil energy sources with renewable sources such as solar, wind and hydropower. This transition is being driven by policy measures such as emissions taxes and subsidies, by the emergence of new technology and changes in consumer and investor preferences.

Chart: *Substantial emissions remain to be cut*

We still have some way to go before Norway's emissions targets are met, either by making cuts in Norway or by buying allowances.[1] The target is to reduce greenhouse gas emissions by at least 55 percent relative to 1990 by 2030 and at least 70–75 percent by 2035. In 2024, emissions in Norway had been reduced by just above 12 percent relative to the 1990 level. The largest reductions since then have been achieved in manufacturing. Over the last ten years, road traffic emissions have also declined substantially, while the electrification of the petroleum installations on the Norwegian continental shelf has helped cut emissions from oil and gas production.[2]

According to a survey conducted by Norges Bank in August this year, approximately 40 percent of firms are planning to invest in order to reduce their emissions in the coming years.[3] Many firms are also investing to direct production towards green markets and products.

Chart: *Higher emissions prices incentivise cuts*

Looking ahead, higher costs related to greenhouse gas emissions will strengthen incentives to cut emissions. A large share of the Norwegian business sector is either subject to carbon tax or required to buy emissions allowances in the EU Emissions Trading System (EU ETS), or both. However, current emissions prices, in particular for manufacturing, are far lower than what it would cost to cut all emissions. The political authorities have clearly signalled that domestic carbon taxes will increase in the years ahead. At the same time, emissions allowance prices are expected to rise. This means that GHG emissions will become more expensive in the period to 2030 and to 2040,

Chart: *Much of Norway’s oil and gas has been extracted*

The design of climate policy ahead will be significant for the Norwegian oil and gas industry.

As these calculations from the Norwegian Offshore Directorate show, Norwegian oil and gas production will decline over time.[4] A substantial proportion of the resources has already been extracted. The pace of the decline in activity will depend on for example exploration activity and willingness to invest, which may in turn be influenced by Norwegian and international climate policies. The scenarios shown in the chart define a range of possibilities.

Today, oil and gas exports account for almost half of Norway's total exports, and the petroleum sector accounts for more than 20 percent of total investment in the Norwegian economy. The activity on the continental shelf has significant spillovers to the rest of the economy. Norway has developed a significant oil services industry which also operates abroad. As activity on the Norwegian shelf and internationally declines, firms and labour engaged in activity on the continental shelf will have to redirect towards other activities.[5]

Chart: *Decline in petroleum investment*

Yet investment is still being made on the shelf, and petroleum investment has increased markedly in recent years, reflecting the launch of a number of development projects in 2022 in response to the petroleum tax package and high oil and gas prices. Investment in these projects will fall markedly ahead and will likely not be fully replaced by new projects. This will result in a decline in overall investment over the next three years. Signals from the largest oil and gas companies indicate that investment will then be relatively stable until the mid-2030s.[6]

Chart: *Power sector investment will increase*

The transition also generates new activity and creates new jobs. I have already mentioned investment in greenhouse gas emissions reduction and in new product development. Investment in the power grid and renewable energy is also planned to meet the increased demand.[7] In addition, investment is being made in carbon capture and storage. Considerable investment has already been made at the plant in Øygarden outside Bergen, with further substantial investment planned.[8]

The transition will also have consequences for electricity prices. Norway is connected to the European energy market. The EU's goal is that an increasing share of its energy production is from sources such as solar, wind and hydropower. At present, we lack the storage facilities to balance production fluctuations from these sources. The transition to renewables may therefore result in less stable electricity production, resulting in increased price volatility, which could also pass through to Norwegian electricity prices, as we experienced in late 2024. Calm weather in Germany combined with lower temperatures resulted in a surge in Norwegian electricity prices.

Economic effects of climate change

Chart: *Climate change and transition*

The transition to a low-carbon economy will therefore impact the economy through many channels. However, global warming in and of itself also has substantial economic consequences.[9]

For Norway, a warmer climate is not entirely negative, as it could boost crop yields, make it possible to work outdoors more frequently and attract more tourists. However, this is not the case in large parts of the world. Extreme heat sometimes makes it impossible to work outdoors and labour becomes less productive. Global food production may be particularly affected. A number of studies indicate that agricultural output may fall and push up global agricultural prices over time.[10]

Chart: *More extreme weather*

A warmer climate also means more unstable weather and rising sea levels. Droughts, floods and hurricanes can cause major damage to crops, buildings and infrastructure. The number of extreme weather events has also increased in Norway in recent years, and Storm Amy is just the most recent. The chart shows the number of municipalities affected by severe natural events.[11] Reconstruction costs can be high, and over time, higher insurance payouts linked to weather events can lead to higher insurance premiums. But investment to upgrade buildings and infrastructure to withstand such events will also impose costs on society.

Damage caused by extreme weather affects the output side of the economy. Until the damage is repaired or the next crop is harvested, the potential to supply goods and services is lower than before. This may stoke inflation. If extreme weather events occur frequently, price volatility can also intensify.

Chart: *Extreme weather affects food prices*

In a global market, the ripple effects from a single event can be far-reaching. The rapid rise in food and beverage inflation in Norway over the past year can in part be traced back to the sharp rise in coffee and cocoa prices, and further to droughts in Brazil and heat waves in West Africa. Last autumn, olive oil was among the food products with the highest rise in prices, due to lower olive production in Europe as a result of droughts in Spain and Italy the preceding year.[12]

Coffee, cocoa and olive oil account for a small share of Norway's consumption, and the jumps in prices had little effect on the inflation outlook. However, with a more variable climate, we may see pronounced jumps in prices for food and other climate-sensitive goods more frequently.

Extreme weather affects us all both directly and indirectly. Researchers at Norges Bank have examined the relationship between weather events in Norway and the income, wealth, property transactions and consumption of all households.[13] Two findings are of particular interest. In areas affected by extreme weather events, affected households' labour income and consumption decline compared with unaffected households. This is despite the fact that households in Norway are almost fully insured against the risk of damage caused by climate-related events. In addition, property prices then decline, likely because the area is perceived as more unsafe or because natural events that affect local jobs make the area less attractive.

If global warming continues, more Norwegian buildings will be in areas exposed to flooding, landslides and storm surges. Many of these buildings are mortgaged. Norges Bank has estimated the share of commercial real estate loans that may be exposed to storm surge risk in 2021 and 2090, respectively, and the share could more than double. Looking ahead, more bank exposures could be to buildings in risk zones. This applies in particular to banks with considerable exposure in Western Norway. Borrowers living in risk zones may have to pay higher interest rates.

What does the transition and climate change mean for monetary policy?

Based on what I have said so far, what are the implications for variables that are important for monetary policy?[14]

First, the transition and climate change can affect consumer prices. A larger share of renewable energy in electricity production may lead to more variable electricity prices, while more frequent extreme weather events may give rise to higher volatility in other prices, particularly for food. Moreover, higher temperatures could drive up global food prices. Taxes and allowances affect relative prices but can also push up near-term inflation overall.

Second, the demand side of the economy will be affected. While the need for both higher investment to cut emissions and a larger supply of renewable energy will increase demand, lower petroleum investment will have a gradual dampening effect.

Finally, there are the effects on potential economic output. Both the phasing out of fossil-based productive capital and climate-related damage can dampen potential output. Moreover, potential output is determined by productivity growth, which depends on whether climate-related investment generates more economic productivity than other investment.

Norges Bank has been tasked by the authorities to keep inflation low and stable. The target is inflation of close to 2 percent over time. Monetary policy shall be forward-looking and flexible so that it can contribute to high and stable output and

employment. Monetary policy is also intended to counteract the build-up of financial imbalances.

Both climate change in itself and the transition to a low-carbon economy can impact inflation, output, employment and other variables that are important when we set the policy rate.

So, what does this mean for monetary policy?

Chart: *The Phillips curve - the economy's supply side*

When we in Norges Bank address new issues, macroeconomic models are often used as a framework. Let us begin with a key relationship in our models, the so-called Phillips curve.

The Phillips curve describes a positive relationship between output and inflation. When output is high relative to potential economic output, demand for labour, goods and services pushes up wages and prices. Conversely, price and wage inflation will be low when output is low relative to potential output.

Let us first examine the consequences of a change in demand for goods and services. Higher investment to reduce emissions or increase the supply of renewable energy is an example of such changes.

Chart: *Demand shock*

In the chart, the economy is assumed to be in an equilibrium, with inflation at target, π^*, and output at potential – illustrated by point A. Firms meet higher demand by increasing output, and capacity utilisation increases, pushing up inflation. If we move up the Phillips curve, from A to B, a central bank whose aim is to keep inflation low and stable will respond by raising the policy rate. This helps cool the economy and thus provides room for the increased investment. The higher policy rate brings the economy back to the starting point.

In this case, there is little or no trade-off between stable inflation and high and stable employment.

Now let us see what can happen in the event of a transient supply shock. One example may be that crops are destroyed abroad, which pushes up imported goods prices.

Chart: *Supply shock (step 1)*

The Phillips curve now shifts up. Those demanding goods and services must pay more to purchase the same as before. For unchanged output, y^*, inflation rises above the inflation target and moves from point A to point B in the chart.

The task of monetary policy is to curb inflation. The question is then by how much and at what cost.

Chart: *Supply shock (step 2)*

In principle, the central bank can raise the policy rate to such an extent that inflation rapidly returns to target. The impact is transmitted through reduced demand. The cost is lower output and employment, illustrated by point C in the chart. In other words, the result is a short-term trade-off between keeping inflation stable and employment high and stable.

Chart: *Supply shock (step 3)*

For a central bank that gives weight to both inflation and employment, the result in our chart, point C, is not a reasonable trade-off. The Bank can instead choose to raise the policy rate somewhat less, resulting in inflation somewhat above target for a period while output approaches potential. This is shown by point D.

Chart: *Supply shock (step 4)*

As the subsequent harvest results in normal yields, imported inflation will move down again, and the Phillips curve shifts back to the starting point. The central bank can then reduce the policy rate, bringing us back to the starting point (A).

This example has much in common with the situation we have faced in Norway, following the import price shock in the wake of the pandemic. We could have brought inflation back to target by implementing larger rate hikes more rapidly, but by spending some time to bring inflation down, we have avoided a large increase in unemployment.

Looking ahead, we have to be prepared for climate-related events to be a more frequent source of supply and demand shocks. If there are larger and more frequent supply shocks, we will have to weigh the two monetary policy objectives against each other more often.

Some might ask whether it is obvious that the central bank should raise the policy rate at all if inflation rises due to a weather-related event.

We largely disregard short-term fluctuations in individual prices. We would normally only change the policy rate if we expect changes in individual prices to spill over to other prices and wages and lead to a broad-based change in consumer price inflation. For example, there was little reason to worry about persistent inflation on account of the sharp rise in cocoa prices earlier this year. If inflation rises, we must assess whether we expect the rise to be temporary or whether there is a risk of a more persistent rise.

Climate change may lead to more frequent individual climate events that push up prices. If the central bank chooses to look through each individual event, average inflation over time could exceed the target.[15] If firms and households begin to expect this and assume higher inflation when setting prices and wages, inflation may become entrenched. This may make it more costly to bring inflation down to target.

Climate-related events may therefore make it more difficult to ensure price stability ahead. By looking through temporary changes in inflation, we can avoid causing unnecessary variations in unemployment. But if we raise the policy rate too little when inflation increases, we run the risk of inflation expectations rising and confidence in the inflation target weakening.

How will the neutral interest rate be affected?

So far, I have discussed how climate-related events may lead to shocks to both the supply and demand side of the economy that monetary policy must respond to. Climate change and the transition may also have consequences for the normal interest rate level in the long term or what we often refer to as the neutral rate.

The neutral interest rate cannot be observed and must therefore be estimated and could also change over time. After the financial crisis in 2008, global interest rates declined and eventually so did our estimate of the neutral interest rate. In the years preceding the pandemic, the neutral rate was very low. In recent years, we have again revised up our estimates and we now envisage that a normal policy rate level can lie in the interval between 2.25 percent and 3.5 percent somewhat further out.

How climate change and the transition will affect the normal interest rate is uncertain. The transition to a low-carbon economy requires substantial investment. This may pull in the direction of a higher neutral interest rate. On the other hand, the neutral interest rate may decline if uncertainty regarding the path of climate policy and the consequences of climate change curb the willingness to invest or lead to a stronger desire to save. Productivity growth also affects the neutral interest rate. If climate-related investment crowds out more productive investment in the near term, this will pull in the direction of a lower neutral interest rate. If the transition over time contributes to higher productivity growth, this may indicate a higher neutral rate.

As you well know, many questions remain unanswered,

Should monetary policy take climate considerations into account?

The mandate for monetary policy is laid down by the political authorities. The current monetary policy regulation has remained unchanged since 2018. The Ministry of Finance announced earlier this year that the mandate will be reviewed. Thus, the

Ministry has requested that Norges Bank assess our experience of the current regulation and the lessons we and other central banks have learned from large supply-side shocks in recent years.

In a review of the mandate, it would be natural to discuss the tasks of monetary policy and the weight given to the various objectives. One question could be whether to include climate considerations in the monetary policy mandate.

Determining Norges Bank’s mandate is the responsibility of the political authorities but allow me to emphasise some factors that I think should be included in that discussion.

A key consideration when formulating the monetary policy mandate is that the objectives must be consistent with what the Bank's instruments can influence.

Norges Bank’s policy rate is not a targeted instrument for contributing to climate transition as it has a broad impact and affects virtually all parts of the economy. Targeting specific industries or investment projects is not possible.

The responsibility for reducing greenhouse gas emissions and the most effective instruments to do so are in the hands of the political authorities. The pricing of these emissions is important as it provides a clear signal about what we should do less and more of.

Norges Bank's monetary policy toolkit has the instruments needed to maintain inflation at close to 2 percent over time. The transition requires investments – many with uncertain earnings that lie far into the future. It is safer to make such investment in an environment of low and stable inflation.

Stable prices also make it easier to distinguish between changes in the prices of individual goods and a general rise in prices. For example, the signal from higher carbon taxes becomes easier to capture, pulling the transition in the right direction.

Conclusion

Chart: The earth is heating up

Let me conclude. In 2025, ten years have passed since the signing of the Paris Agreement, when a target was set to limit global warming to 1.5°C above pre-industrial levels. Significant rises in temperature in recent years are a serious warning. The less we manage to limit global warming, the more serious the consequences for weather, nature and people will be. There is considerable uncertainty regarding future temperature developments, which also leads to considerable uncertainty about the economic consequences of climate change and energy transition. In the conduct of monetary policy, we will in any case need to take

into account that climate change may entail more frequent supply-side shocks in the economy ahead. Flexible inflation targeting makes us well equipped to meet such shocks.

Footnotes

[1] Norway's emissions target is set out in the Climate Change Act and reported to the UN as part of Norway's commitments under the Paris Agreement. This target will mainly be achieved through national measures and in collaboration with the EU.

[2] See the Norwegian Environment Agency: Norske utslipp og opptak av klimagasser, for emission data. [Norwegian greenhouse gas emissions and absorption] (in Norwegian only).

[3] Responses are from a special topic in the autumn 2025 Regional Network survey. The survey covers Norwegian firms, excluding oil and power companies.

[4] Norwegian Offshore Directorate (2025) "Resource report 2024"

[5] According to the assessment in Official Norwegian Reports (NOU) 2023:30, there are positive prospects of resources freed up from the petroleum activities and the oil services industry finding use in other areas of the economy. See Official Norwegian Reports (NOU) 2023: 30 – at regjeringen.no [in Norwegian only]

[6] The petroleum investment estimates are based on Statistics Norway's investment survey, investment forecasts from the Norwegian Offshore Directorate, information on investment plans provided by oil companies and oil and gas futures prices.

[7] We assume here that the offshore wind projects at Sørlige Nordsjø II and Utsira Nord will be completed. There is considerable uncertainty surrounding these projects. For them to be completed, cost levels in the offshore wind industry will likely have to fall appreciably from current levels. The estimates for the other components are based on analyses from the Norwegian Water Resources and Energy Directorate, Statistics Norway's investment survey, Statnett's estimates for own investment and other information about investment plans in the power sector.

[8] See Equinor

[9] The Network for Greening the Financial System (NGFS), in which Norges Bank participates with other central banks and supervisory authorities, has prepared research-based scenarios. The scenarios show that an orderly and early transition will cause less economic damage than one that is delayed and abrupt. In a scenario

where the world reaches net zero emissions by 2050, losses in output are relatively small, while in a scenario where little is done to stop climate change, economic losses may be substantial. Link: NGFS Climate Scenarios for central banks and supervisors - Phase V | Network for Greening the Financial System

[10] See projections of food price inflation and overall inflation arising from a warmer global climate in Kotz, M. et al. (2024), "Global warming and heat extremes to enhance inflationary pressures", *Communications Earth & Environment 5:116*, www.nature.com

[11] Natural events are defined as severe when direct damages amount to at least 5 percent of residents' labour income in the municipality.

[12] In the chart, the "price of the good in Norway" refers to the price component included in the CPI-ATE. The bars show the cumulative change in prices from when the event occurred until the rise in prices was at its most pronounced.

[13] Espegren, C., S. M. Galaasen, E. Garcia-Appendini and M. Mæhlum (2025) "Weathering the Storm: The effects of Natural Disasters on Households under Universal Insurance" *Unpublished manuscript.* Draft available via the following link: dropbox

[14] For a review of the macroeconomic and monetary policy effects of climate change and the transition to a low-carbon economy, see NGFS (2024) Climate change, the macroeconomy and monetary policy, NGFS Technical Document

[15] Beaudry, P., T.J. Carter and A. Lahiri (2023) The Central Bank's Dilemma: Look Through Supply Shocks or Control Inflation Expectations? | NBER