

# ENOVA

Annual Report 2019



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*For information, see Norwegian version at [enova.no](http://enova.no)*

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## The crucial high-hanging fruits

**We're on the threshold of a decisive decade. The Government recently announced that Norway will cut its emissions by at least 50 per cent by 2030, when the transition needed to be a low-emission society in 2050 will have to be fully under way. Does 2019 show that these two goals can be unified, or is the hunt for quick emission cuts displacing long-term work?**

The temperature is rising, not only on Earth, but also in the climate debate. While some seem to fear the transition more than actual climate change, the voices calling for action are getting louder. The youth climate strikes around the world are a good example of this. An entire generation mobilised over the last year.

At the same time, we can see that the climate issue is rising on the political agenda. Last year, the European Commission launched its ambition for Europe to be the world's first climate-neutral continent by 2050.

This took place alongside Norway's climate agreement with the EU being adopted in Brussels. Norway committed to emission cuts of 40 per cent in sectors not subject to emission credits by 2030. In February 2020, the Government announced that these goals would be bolstered by further increasing the level of ambition, to 50–55 per cent emission cuts leading up to 2030.

Aspirational ambitions are a good thing – but what should be prioritized? Since emission cuts are an urgent priority, it could be tempting to focus climate work over the next ten years on low-hanging fruit, i.e. simple measures that provide immediate emission cuts and direct results in relation to the 2030 goals. This means it's important to remember that 2030 is not a finish line, just a checkpoint. If 2030 is a rehearsal, then 2050 is the grand opening. When Norway takes stock in ten years, the emission

levels there and then will not tell the full story of our status. Much of the answer to what it will look like in 2050 can be read from whether or not we have laid the foundation for further emission cuts and necessary economic transition by 2030.

Cutting emissions is important and the right thing to do when the measures are easy and the solutions are available, but we can't limit ourselves to these low-hanging fruits. This fruit tree has to be nearly bare by 2050 but unfortunately, picking low-hanging fruit will not make it easier for us to reach the fruit further up. On the contrary, it could create a false impression of progress.

Norway has to work on short-term emission cuts while simultaneously laying the foundation for the truly challenging – and necessary – emission cuts waiting for us after 2030. This means that society has to act now to invest in ambitious technology developments even though it will take years before these developments yield concrete emission reductions. However, Norway is entirely dependent on these developments to reach the true goal; realising a low-emission society with the level of general welfare we are accustomed to today. Some of this technology will take such a long time to go from idea, research and development to commercialisation and market standard, that Norway will face considerable challenges in reaching the 2050 goals if this work is not well under way in 2030.

In 2019, Enova saw a number of examples in the markets of both picking low-hanging fruit and developing methods to harvest the rest of the tree. 1 484 projects in Norwegian enterprises with funding commitments totalling NOK 5.2 billion is a new record for us, measured both in number of projects and kroner. This record was set with a large contribution from another milestone, namely NOK 2.3 billion in support for the world's largest floating offshore wind farm – Enova's largest single commitment ever.

The Hywind Tampen offshore wind project is a shining example of how Enova can help bring a technology that is necessary for the low-emission society one step closer to commercialisation. If Norway is successful in building an industry for floating offshore wind, this will have positive ripple effects for both the climate challenge and the Norwegian private sector for a long time to come. In this perspective, the project has the potential to be one of Norway's greatest contributions to the global climate movement.

2019 was also filled with a number of other highly promising technology projects. Here we can mention projects like solar cell innovation by REC Solar, thermal energy storage by Kvitebjørn Varme, ASKO's autonomous freight vehicles and more than NOK 200 million for eight projects aiming to demonstrate tomorrow's solutions for a large-scale, resilient energy system.

The large innovative projects often get the most attention, but it's not enough to simply develop the technologies. It's equally important to ensure that the technologies are then disseminated and utilised to a sufficient degree. 2019 was a good year by this measure as well. Over the course of the year, Enova was tasked with administering the new Zero-Emission Fund, a collection of support programmes aimed at cutting emissions in commercial transportation through an efficient roll-out of zero-emission solutions. In addition to our existing programmes which aim to help increase the volume of new, available technology in the transport sector, we introduced support for procuring electric delivery trucks as a new feature of the Zero-Emission Fund. This is also the first of Enova's support programmes for the private sector to utilise automated and immediate application processing. This support programme was well-received and the market responded rapidly.

Together, the offshore wind farm and electric delivery trucks show the broad scope of Enova's contribution to this transition; from early-phase development of the truly vast technological revolutions needed to build a low-emission society, to an increased volume of the solutions already available, but which are struggling to gain a foothold in the market. Once the technologies overcome this hurdle, it will be time for Enova to pull out and allow other policy instruments – such as statutes and regulations – to take over.

We've seen a fresh example of this in the construction sector. 2019 was the last year of direct greenhouse gas emissions from Norwegian buildings, as the prohibition against fossil oil furnaces entered into force on 1 January 2020. Enova was part of laying the groundwork for this prohibition through its support for transitioning to renewable solutions in both households and non-residential buildings. But even zero-emission buildings will play an important role in the further transition, and Enova's focus in the construction sector will now be on reducing energy consumption and limiting the impact on the power grid through measures to reduce demand. Here it will be important to have the industry on our side. Even though Enova raised the bar for which measures we will support – thus requiring the stakeholders to go even further – we are receiving a good stream of inquiries from the construction sector.

Norwegian homeowners are also contributing to the transition in unprecedented numbers. Last year, we disbursed a total of NOK 334 million in support to 20 789 energy measures in Norwegian homes. Both figures are historic highs. Phasing out 2 848 old oil furnaces is just a small part of the picture. In general, we are experiencing steadily increasing interest in improving energy standards at home.

*"The many small and large steps now being taken in Norwegian homes and businesses are not signs that Norway is ready for the transition – they **are** the transition."*

How does one run a marathon? One step at a time. By this logic, although we're facing a significant transition leading up to 2050, it might not seem so insurmountable along the way. Our day-to-day lives are going to change substantially over the next thirty years, but this has always been the case. Looking back thirty years, our everyday lives were filled with things like landline telephones, tax returns you had to fill out yourself, chequebooks and physically going to the bank to pay your bills. Knowledge was sold door-to-door in the form of the Great Norwegian Encyclopaedia. The technology development behind all this left its mark on society, both on us as individuals, on businesses and the private sector. At the same time, this is hardly considered a sacrifice today. On the contrary, most people might say that this development improved our lives – it was a conscious and necessary adaptation.

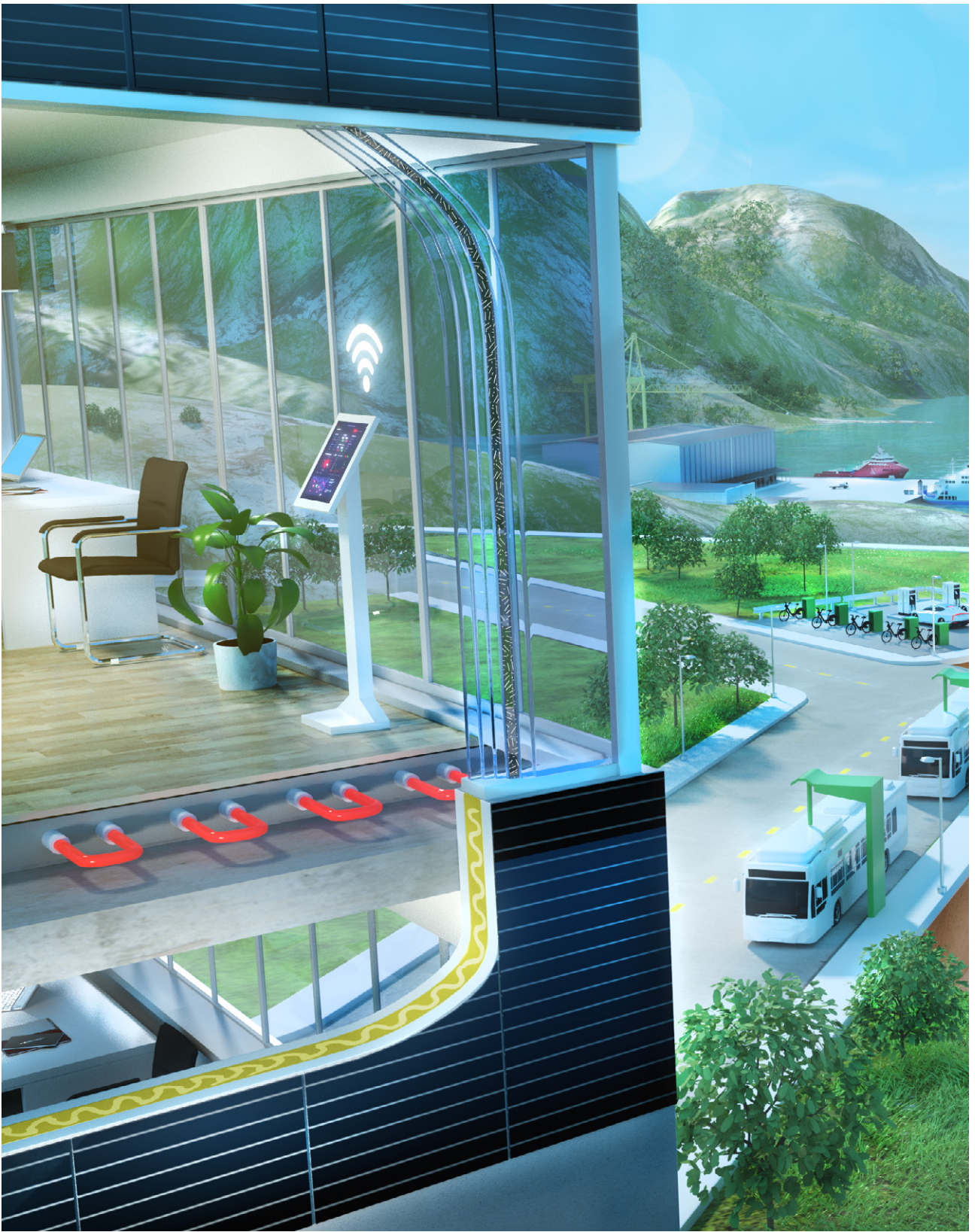
As Enova is now experiencing increased activity and commitment from both the private sector and the general population, this could be an expression of a growing acceptance of the new transition?

From Enova's standpoint, 2019 was an important step in the right direction, but a single step has little value without the following steps. Regardless of sector, the following should therefore be the challenge for the decisive decade we're facing: Work actively on measures that can cut emissions today, but not lose sight of the long-term tasks the transition will demand.

We are confident that, when Norway looks back on this decade in 2030, it will be with a sense of pride in what we as a society have achieved, and with the certainty that the 2050 goals are in reach. Enova is prepared to team up with all good forces to make this a reality.

  
Nils Kristian Nakstad

Chief Executive Officer (CEO)



# PART II

# INTRODUCTION OF THE ORGANISATION AND KEY FIGURES

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# Social mission

**Enova SF** is a state enterprise located in Trondheim. Enova SF is owned by the Ministry of Climate and Environment (MCE).

**The Ministry of Climate and Environment (MCE)** is responsible for the totality of the Government's climate and environmental policy. The MCE issues Enova's assignment letter and receives our reporting.

**The four-year agreement** between the State and Enova applies for 2017–2020 and sets the framework for the social mission. The agreement will ensure that the resources from the Climate and Energy Fund are managed in accordance with the goals and preconditions at the foundation of the Climate and Energy Fund.

The purpose of **Enova and the Climate and Energy Fund** is to contribute to reduced greenhouse gas emissions and

strengthened energy security of supply, as well as technology development that also contributes to reduced greenhouse gas emissions in the longer term.

**Enova shall promote:**

- a. Reduced greenhouse gas emissions that contribute to fulfilling Norway's climate commitment for 2030.
- b. Increased innovation within energy and climate technology adapted to the transition to a low-emission society.
- c. Strengthened security of supply through flexible and efficient demand and energy consumption.

Enova will establish instruments with the aim of achieving lasting market changes. The ultimate goal is that efficient energy and climate solutions should be preferred without support. The activity can be aimed at all sectors.

## Enova's vision is *Vibrant change*

**Our values:**

**Market-oriented**

**Bold**

**Always learning**

**Thorough**

**Ethical guidelines**

Our ethical guidelines and fundamental values are Enova's rules of conduct for behaving ethically and in a socially responsible manner.

- We have goals, values and ethical guidelines that describe the founding philosophy and actions which will characterise our organisation.
- We exercise corporate governance principles where we emphasise openness, transparency, responsibility, equality and long-term perspectives.
- We demand high integrity standards, which for example entail that we do not tolerate any form of corruption, and that we promote free competition.
- We must be open, honest and responsive in communication and contact.
- We do not discriminate based on gender, sexuality, religion, nationality, ethnicity, societal group or political opinion.





# Management



## Nils Kristian Nakstad

Chief Executive Officer (CEO)

Nils Kristian Nakstad has been the enterprise's CEO since 2008. He is a chartered engineer from the Norwegian University of Science and Technology (NTNU) and has extensive experience from research and industry, including from Sintef, Hydro, ReVolt Technology and participation in the seed capital and venture community. Nakstad is on the NTNU board of directors.



## Øyvind Leistad

Director of the Marketing Department

Øyvind Leistad has been the Director of the Marketing Department since 2019, and has held a number of executive positions in Enova. He was hired as a senior adviser in 2005. From 2007–2012, he was the Director of the Energy Production Department and from 2013–2019, he was the Director of the Development Department. In 2018, he also served as the Marketing Director. Leistad has an educational background in resource economics, financing and investment from the Agricultural University of Norway. He has experience from the Ministry of Petroleum and Energy (MPE), where he worked with administration of various policy instruments related to stationary energy supply and renewable energy, and energy efficiency in particular.



## Gunn Jorun Widding

Director of Enterprise Management

Gunn Jorun Widding has been the Director of Enterprise Management since 2013. She is a chartered economist from the Bodø Graduate School of Business (HHB). She also has a number of courses from the university colleges in Sør-Trøndelag, Bodø and Lillehammer. Widding has previous experience from management positions in the travel industry, project management and several executive positions in EVRY.



## Petter Hersleth

Acting Director of Strategy<sup>1</sup>

Petter Hersleth has served as Acting Director of Strategy since May 2019. He has a civil engineering degree from the Norwegian University of Science and Technology (NTNU). Hersleth has broad experience from the energy industry, including Statkraft and Multiconsult. He was hired by Enova as an adviser in 2013. In 2015–2017, he was part of the team developing Enova's transport programmes as marketing manager for the transport area. He has led the Business Development area since 2017, and remains in this position.

<sup>1</sup> Stein Inge Liasjø resigned as Director of Strategy and Communications in May 2019.

# Organisation

Enova has been entrusted with administering State resources in a manner that yields the greatest possible benefit for society. In order to deliver proficiently on the goals in the assignment, Enova has high ambitions for developing the organisation. Enova is carrying out a multi-year project for comprehensive corporate governance and organisational development – named Project 42.

Enova is continuously working to develop the organisation. The crux of this work is to ensure a shared understanding of our goals throughout the organisation and that we develop in line with the ambitions in our overarching work process – the Enova process.

The work on digitalisation and improving work processes has seen good progress in 2019. A reorganisation was carried out, in which we went from four to three departments, clarified interfaces between departments and areas, established a dedicated area responsible for analysis and insight work, and also reviewed role descriptions. In 2019, Enova moved to new premises, where significant emphasis has been placed on flexible physical design which supports variation in forms of work and facilitates multiple alternative ways to solve work tasks.

Enova's greatest asset is the expertise of each employee and knowing how we can put this to use through good interaction in combination with the organisation's systems and processes. Enova works with the goal of being an attractive workplace and endeavours to support each person's strengths and desires to do

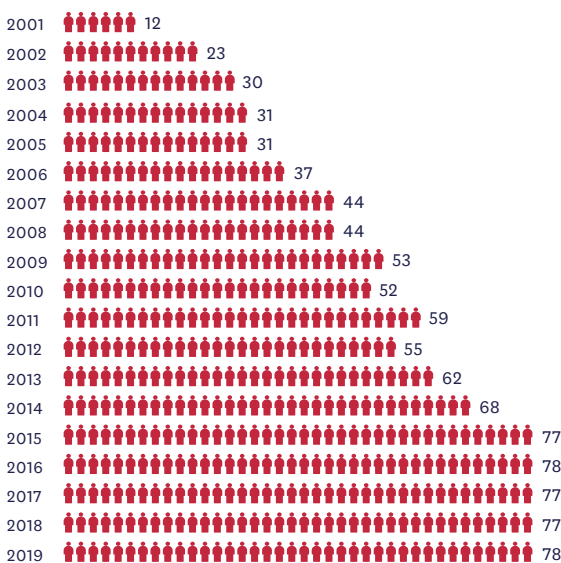
their best. The enterprise exercises value-based management, and works to ensure that our values (*market-oriented, thorough, bold and always learning*) are the foundation of internal interaction and our contact with the world.

Enova has 78 permanent employees – 38 women and 40 men. Their education and work experience varies within a number of disciplines. Enova sees the value of gender equality and diversity in the workplace, and believes this strengthens our ability to think broadly and take on different perspectives.

The enterprise is organised in three departments, each with special tasks and responsibilities:

- The **Marketing** Department communicates Enova's services to the market, provides advice and handles questions concerning financing and client contact. This department develops programmes, processes and follows up supported projects.
- The **Enterprise Management** Department handles support functions within finance, IT and HR.
- The **Strategy** Department works on the long-term strategy for delivering on the assignment, the overarching framework conditions for the business and communication with our stakeholders.

## Development in number of employees

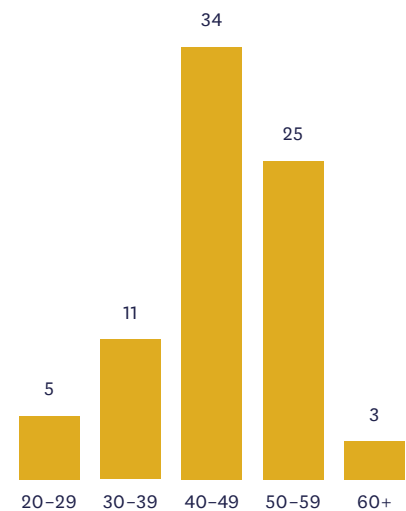


49%  
Women



51%  
Men

## Age composition



# Key figures

## Key figures for Enova SF

Key figures for Enova SF are prepared based on the standard for public enterprises. Because Enova SF is a state-owned enterprise which follows other accounting standards and has a different financial model, the key figures will not be directly comparable with corresponding key figures for central government agencies.

Key figures	2019	2018	2017	Description
Full-time equivalents	72.1	73.5	75.2	Full-time equivalents includes/include all permanent, temporary employees, summer students and hired capacity from staffing agencies. Full-time equivalents are reduced where employees have reduced hours, have resigned during the course of the year, are on unpaid leave, family leave or have been on long-term sick leave.
Total allocation (NOK million)	152.6	146.2	140.3	Total allocation consists of administration contribution, as well as earned equity at 1 Jan.
Utilisation rate	104%	100%	93%	The utilisation rate is calculated as total operating expenses as a percentage of the administration contribution.
Administration contribution (NOK million)	126.9	124.0	125.2	The MCE stipulates a framework for administration contribution for Enova SF. The framework is entirely financed with contributions from the Climate and Energy Fund. Amounts do not include Value Added Tax.
Percentage of wages in administration contribution	73%	71%	69%	The percentage of wages in administration contribution emerges as payroll costs and costs for hired capacity from staffing agencies, as a percentage of the administration contribution. Payroll costs include all social costs (incl. pension costs).
Payroll costs per full-time equivalent (NOK)	1 293 086	1 204 587	1 145 443	Payroll costs per full-time equivalent consist of wage costs and costs for hiring capacity from staffing agencies, divided among the number of completed full-time equivalents. Payroll costs include all social costs (incl. pension costs).
Percentage of consultants in administration contribution	10.8%	9.7%	4.9%	The percentage of consultants in the administration contribution consists of purchase of consultancy services, as a percentage of the administration contribution.

## Key figures for the Climate and Energy Fund

Key figures	2019	2018	2017	Description
New commitments (NOK million)	5 815	2 326	2 582	New commitments shows/show how much Enova has allocated from the Climate and Energy Fund to support projects, contractual activities and administrative contribution.
Disbursed from the Climate and Energy Fund (NOK million)	2 026	2 356	2 356	Disbursed from the Climate and Energy Fund shows how much has been disbursed to projects, contractual activities and administrative contribution. Disbursements made during the year to projects adopted during the period 2009–2019.
Added to the Climate and Energy Fund (NOK million)	3 283	2 792	2 659	The key figure shows how much was added to the Climate and Energy Fund through allocations via the Fiscal Budget, para-fiscal charge on the grid tariff and interest.
No. of projects	1 484	987	931	Number of projects allocated support from the Climate and Energy Fund, except measures funded through the Enova Subsidy.
Number of disbursements from the Enova Subsidy	20 789	14 487	8 123	Shows the number of implemented measures that have received a disbursement from the Enova Subsidy.

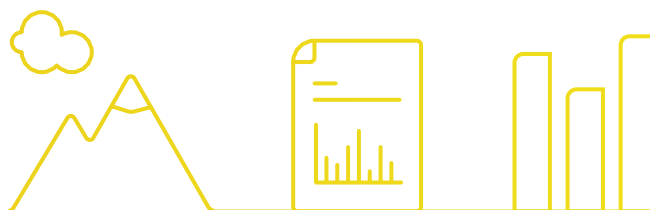


# PART III

# ACTIVITIES AND RESULTS FROM THE YEAR

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## PART III A | Reporting on Enova SF

Enova shall be a flexible and adaptable organisation that manages state resources in the most efficient manner possible. This also means that operation of Enova and administration of the Climate and Energy Fund must be as cost-effective as possible, ensuring that resources are used to the greatest possible extent to realise new energy and climate technology projects in line with Enova's mission.

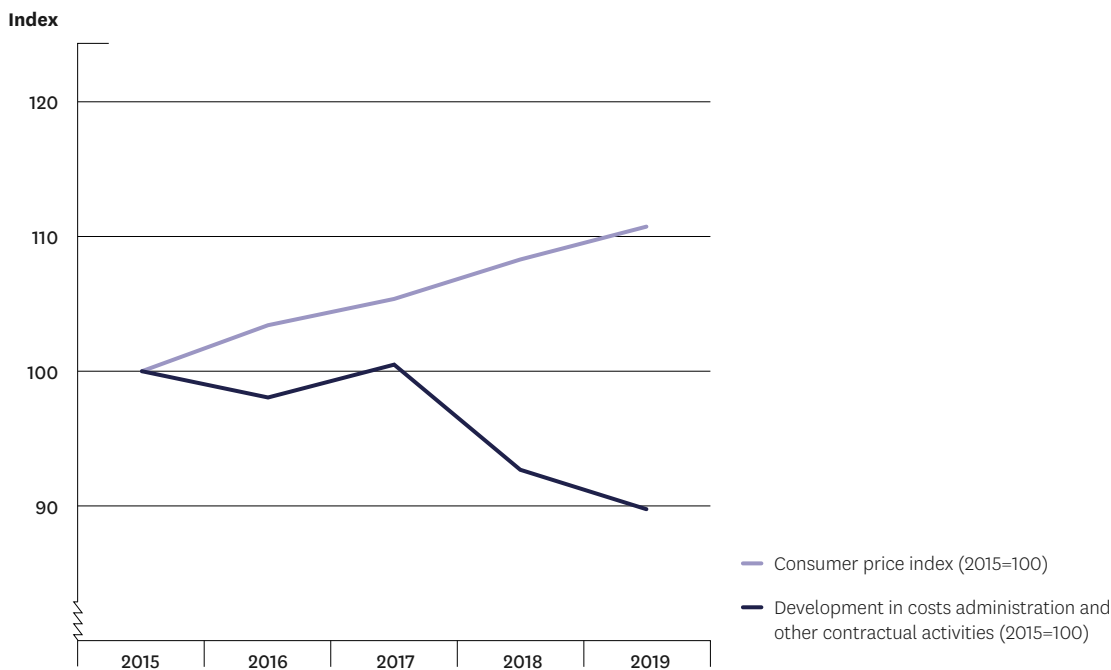
As support in assessing to what extent we are administering the Fund in a cost-effective manner, we have prepared four indicators for each year and a perspective over time.

Beyond investment and feasibility study support for projects, funds from the Climate and Energy Fund are allocated to other contractual activities and administration remuneration. The framework for administration contribution is stipulated by the Ministry in annual allocation letters to Enova.

Figure 3.1 shows that costs associated with administration of the Climate and Energy Fund have displayed positive development measured against the consumer price index for the period, and that there has been a reduction in cost level in recent years.

**Figure 3.1**

Development in costs for administration contribution and other contractual activities in relation to development in the consumer price index



**Figure 3.1:** The figure shows the development in costs for administration and other contractual activities in relation to the development in the consumer price index during the 2015–2019 period (2015 = 100).

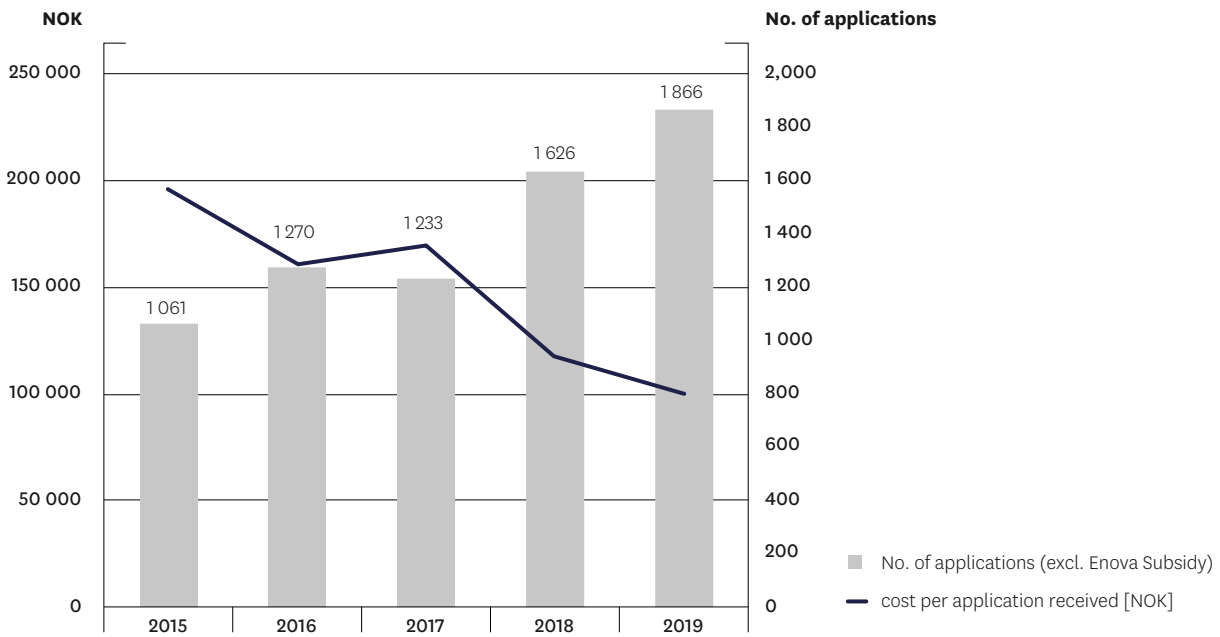
In recent years, Enova has focused significant efforts on digitalisation and automation of our work processes, which provides more efficient project portfolio management and the necessary capacity to handle an increasing number of applications.

Figure 3.2 shows costs for administration and other contractual activities distributed by number of applications received. Decisions associated with the Enova Subsidy are not included in this presentation. The figure shows that the average cost per received application has been reduced by 50 per cent since 2015.

Figure 3.3 shows the ratio of the overall appropriated resources in the Climate and Energy Fund allocated for administration and other contractual activities. In the last few years, this ratio has been around 8 per cent. 2019 saw a sharp decline in the ratio, caused by the substantial award to Hywind Tampen totalling NOK 2.3 billion. Adjusting for this award – as illustrated with the broken line in Figure 3.3 – the ratio for 2019 is 5.6 per cent. If we only look at administration contribution, the ratio is down from 5 per cent in 2018 to 2.1 per cent in 2019. Adjusted for Hywind Tampen, the ratio was 3.6 per cent in 2019.

**Figure 3.2**

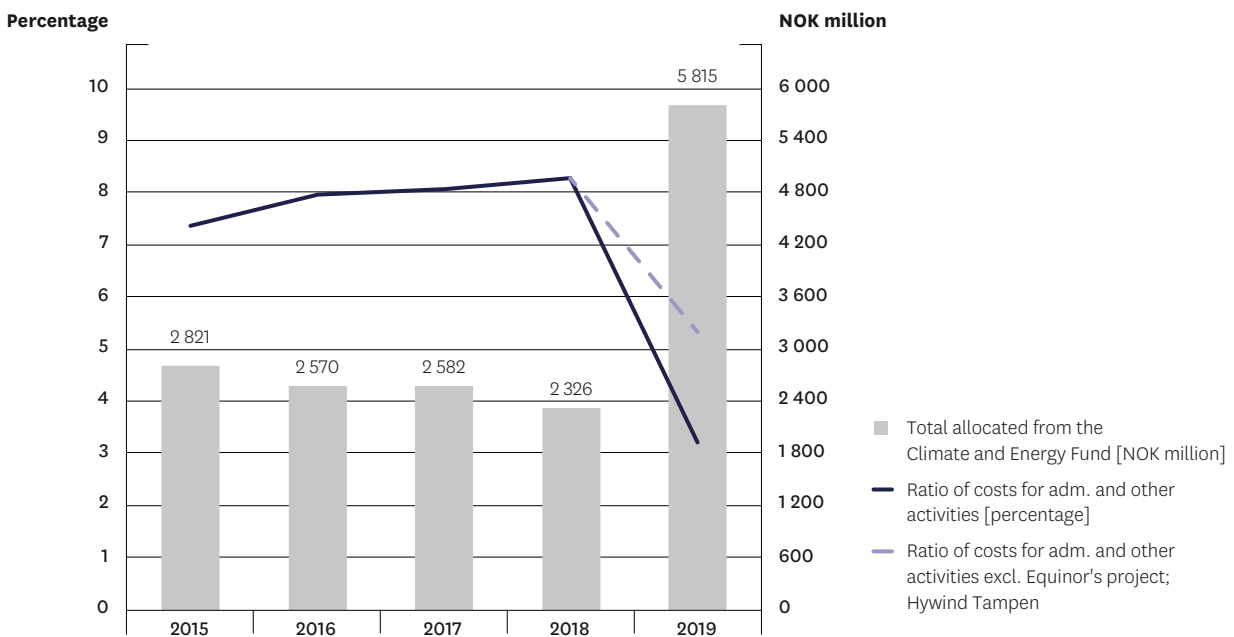
Development in costs for administration contribution and other contractual activities per application received



**Figure 3.2:** The figure shows the development in average costs for administration and other contractual activities per application received during the 2015–2019 period. The figure also shows the number of applications received during the same period. The Enova Subsidy is not included.

**Figure 3.3**

Ratio of costs for administration contribution and other contractual activities by total allocated funds in the Climate and Energy Fund



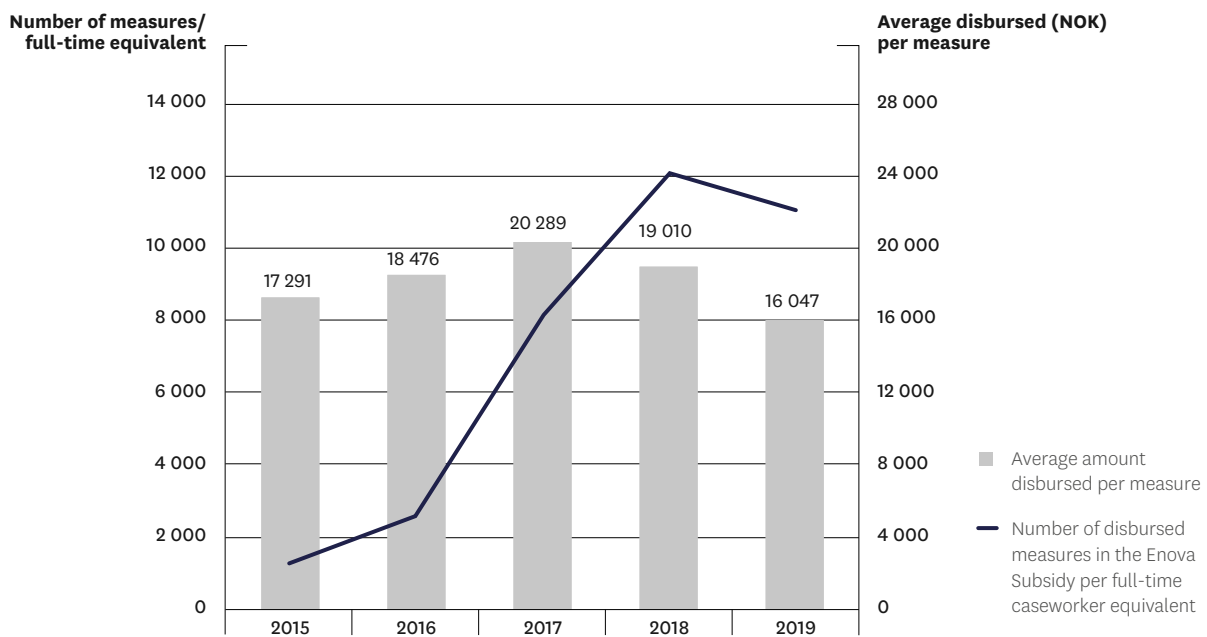
**Figure 3.3:** The figure shows the ratio of costs for administration remuneration and other contractual activities of the total allocated funds from the Climate and Energy Fund 2015–2019.

As regards the Enova Subsidy, we have been working in a goal-oriented manner to streamline the standard application processes, while the number of applications has simultaneously grown substantially in recent years. The figure below shows the development in number of measures processed per full-time

caseworker equivalent under this scheme, and average amount per measure. The number of measures processed per full-time equivalent has declined somewhat from 2018 to 2019, but remains at a very high level compared with previous years.

**Figure 3.4**

The number of measures processed in the Enova Subsidy per full-time caseworker equivalent



**Figure 3.4:** The figure shows average the number of measures processed per full-time equivalent versus the average amount disbursed per measure in 2015–2019.



## PART III B | Reporting on the Climate and Energy Fund 2019

# Objectives

Climate-friendly products and services will not necessarily be successful on the market on their own. New technologies or solutions that can take us toward a low-emission society are often not in either sufficient demand or supply. This could be because they are not sufficiently tested, because they are unknown on the market, because they are not profitable, or simply because they have not yet been invented. Enova's job is to advance development and hasten the necessary changes by triggering actions that otherwise would not have occurred so quickly or even at all, and ensure that these changes take hold in the market. This is what we call lasting market change. This means that how a project contributes to market change becomes just as important as the individual project's quantifiable results in the form of reduced greenhouse gas emissions, increased innovation, reduced energy consumption or reduced peak demand.

### Secondary goal 1:

#### Reduced greenhouse gas emissions that contribute to fulfilling Norway's climate commitment for 2030.

Enova shall prioritise projects that yield reduced greenhouse gas emissions. The transport sector represents about one-third of Norwegian greenhouse gas emissions, and is not included in the EU Emissions Trading System. The sector will therefore be particularly important to Enova in the work on adapting to the low-emission society. Within the sector subject to emission credits, the EU's credit market is the primary policy instrument for reducing emissions.

### Secondary goal 2:

#### Increased innovation within energy and climate technology adapted to the transition to a low-emission society.

Enova shall prioritise its efforts where the possibilities for influencing the development are greatest, and towards technologies and solutions that are adapted to the low-emission society. When

designing policy instruments, Enova facilitates global dissemination and subsequent emission reductions also outside Norway. Through consultation and financial support, we reduce the risk that players take and increase the pace of the energy transition towards more climate-friendly, energy-efficient and competitive sectors.

### Secondary goal 3:

#### Strengthened security of supply through flexible and efficient demand and energy consumption.

Enova will stimulate a faster pace of innovation and a development that supports and bolsters security of supply. We shall contribute to increased energy efficiency, as well as measures that lower electricity consumption, and that yield increased flexibility in the demand for electricity.

### The secondary goals are linked

Reduced greenhouse gas emissions and energy supply are closely correlated factors. Even in a society where nearly all emissions have been eliminated, we will continue using energy. We must use this energy efficiently and it must be renewable. Efficient energy consumption and a reliable, renewable energy supply are therefore important prerequisites for reduced greenhouse gas emissions.

Another important prerequisite for the adjustment to a low-emission society where we still have high value creation and welfare, is the development of new technology. In order for the Norwegian society to succeed with such an adjustment, we must find cheaper and more efficient ways of solving our needs. Enova shall contribute to market changes by allowing fossil-free solutions to outcompete fossil options, based on performance, quality and price. Then we will know for sure that we are moving towards a low-emission society that is also financially sustainable.

## What has Enova achieved in 2019?

### Transport



The road to emission-free transportation is long and requires a broad scope of efforts. Enova's efforts are aimed at both battery-electric solutions, hydrogen, biogas, infrastructure,

energy efficiency measures and logistics solutions. The various efforts are described in this chapter.

## Develop technology and mature hydrogen solutions for demonstration

Hydrogen-based solutions are potential alternatives for the transport sector and some industrial processes that currently use fossil energy carriers as input factors. In order for hydrogen to transition from a potential solution to a feasible alternative, both technology and cost developments will be needed. Enova can contribute to ensure that this development is expedited.

In order to get the value chain up and running, it will be necessary to demonstrate that hydrogen will work under actual operating conditions. This means that suppliers must see the potential for value creation and take initiatives to deliver solutions, and that the players gain experience with what the use of hydrogen will entail for their own operations. There were no projects within maritime transport in 2019 that were mature enough for realisation and thus support from Enova.

However, our contact with the market has identified a number of potential projects that have moved closer to realisation in 2019. Several consortiums have received support through Pilot-E – a cooperative effort between the Research Council, Innovation Norway and Enova – to develop and mature concepts with hydrogen as energy carrier in the maritime sector, and a steadily increasing number of stakeholders are seeing future opportunities here.

No projects within ground transport received support from Enova last year. In 2018, we supported a hydrogen bus project and in 2015, a project associated with hydrogen lorries. The hydrogen lorries have now been delivered and are in use. This project helps ensure that learning and experience are developed both on the supplier side and among users of the technology. This is an important step toward realising additional hydrogen projects in the years to come.

No projects within hydrogen infrastructure were supported in 2019.

## Functioning market for battery electrification at sea

Battery electricity is now the primary alternative to fossil fuels within maritime transport, and is in the process of establishing a foothold within a few vessel groups. The further development will depend on cost reductions throughout the value chain, as well as maturing battery technology that will open new segments for the solution.

Increasing the number of projects utilising batteries will further mature the value chain for battery-electric solutions, reduce costs, increase beneficial effects and reduce risk, thus allowing battery-electric solutions to be utilised in the market without support. Enova is contributing to ensure that this development is expedited.

In 2019, Enova awarded NOK 556 million in support for 39 battery projects for ships, five of which had particularly innovative

solutions. This is an increase from 23 ships in 2018. Enova has also awarded NOK 59 million in support for infrastructure to electrify four ferry connections over the last year.

We have seen a positive development over multiple years in the number of ships with batteries in individual segments, such as the oil service and ferry sectors. This development continued in 2019. Segments that previously had few projects, such as the aquaculture sector, have seen a good development with a number of battery projects over the last year, particularly aimed at work boats and fish carriers. We are also seeing a demand for more advanced solutions in aquaculture, including charging for feed fleets, which could make battery solutions even more relevant.

Other segments have also started to use batteries in their boats. Several freight boats have received support to install batteries in 2019, a development we have not experienced before. This development appears to be driven, in part, by the ongoing fleet renewal in this segment and that greater emphasis is placed on green solutions in new vessels, as well as certain goods owners setting more stringent requirements for the carbon footprint in transport.

Costs for batteries are still higher than for fossil solutions, and there will still be a need for support moving forward. We expect the cost of battery solutions to drop once the supplier value chain can develop further and shipowners can increase both expertise and experience. Several suppliers are able to deliver solutions, including smaller stakeholders. The establishment of two battery factories in Norway in recent years are examples of this.

Experience from an increasing number of battery projects also provides better cost control, which reduces risk for existing and new stakeholders utilising the technology. We are also experiencing heightened awareness surrounding vessels' energy consumption in general in connection with the battery projects.

One example of a positive development is the hybrid-electric catamaran *Brim Explorer*. *Brim* offers various fjord cruises aimed at the tourist segment. The vessel has installed two batteries and can sail at ten knots for ten hours with more than 100 passengers. *Brim Explorer* received NOK 6.8 million in support from Enova in 2018. Now her sister ship *Bram* is being built without support from Enova, funded through a long-term agreement with *Hurtigruten*, where *Brim Explorer* and *Hurtigruten* will provide sustainable nature experiences on Svalbard, among other places.

Within onshore power, Enova awarded NOK 87 million in support to ten projects in 2019, which means that an increasing number of Norwegian ports can provide onshore power. At the same time, the industry is experiencing a positive trend through the development of new business models and collaborative constellations. One concrete example of this is *Plug AS*, a company established by the Port of Bergen and *BKK* to build Europe's largest onshore power facility.

These individual innovative projects provide a basis for further developments. ASKO's sea drone project, which Enova supported with NOK 119 million, demonstrates an autonomous and fully-electric solution for maritime freight transport, and is also a project that demonstrates new comprehensive logistics solutions for freight transport. Regulations for autonomous vessels are being developed in parallel with this project, which is paving the way for increased introduction of such vessels in the future.

### Functioning market for onshore battery electrification

In order to realise the objectives in the National Transport Plan as regards phasing in zero-emission vehicles and construction machinery in the Norwegian market, Norway will depend on international manufacturers increasing their range of models.

Norway is at the forefront of the electrification of light vehicles, and could also stake out a position as an early-phase market and "laboratory" for heavier zero-emission vehicles and construction machinery. Gaining operating experience with heavier zero-emission vehicles could have an effect on production volume in the international manufacturer market. Enova is contributing to expediting the demand for vehicles and experience in their use.

Enova has been working on fast-charging infrastructure for electric vehicles in areas with underdeveloped charging infrastructure. Two tender competitions were announced in 2019 for segments in Finnmark, Troms and Nordland counties. The tenders for development in Finnmark and Troms were still being processed at the end of 2019. The deadline for submitting a tender for the development in Nordland was in February 2020.

In 2019, Enova issued funding commitments for a large swath of zero-emission vehicles and construction machinery: 3 300 electric delivery trucks, support for charging infrastructure to serve 300 electric city buses, 2 electric coaches, 2 electric lorries, 9 electric excavators and 6 electric waste collection vehicles.

In 2019, Enova provided support to public transport companies with charging infrastructure for electric city buses through five tenders. We are seeing a positive development where multiple tenders request battery-electric buses, and an increasing share of the buses in the tenders are battery-electric. Over the course of a few years, the projects have become increasingly larger and more mature – from small test projects with one or two battery-electric buses to major tenders with more than 100 battery-electric buses. The major cities are taking the lead here, and most large public transport companies are now considering electric buses in the tender phase. One precondition for this positive development is a well-developed supplier value chain abroad, which can supply mass-produced electric city buses in large numbers.

As regards small and medium-sized electric delivery trucks, Enova supported one project in 2019. Through Pilot-E, the collaborative effort between the Research Council, Innovation

Norway and Enova, work is under way to establish larger projects for battery-electric lorries that can help suppliers start small-scale mass production.

As regards construction machinery, a number of heavy electric excavators have been utilised in recent years. The multiple projects under way will build the experience the rest of the industry can benefit from in further development. There is currently no mass production of electric excavators; the norm is still to retrofit existing fossil models. This is the reason for the continued substantial price difference between electric and fossil solutions. As far as we know, none of the major international suppliers have any plans for mass production, but we can see that, with an increased volume, there is a form of "mass retrofitting" of existing fossil technology. One positive development from the technology having been demonstrated is that this allows for zero-emission construction site requirements, where the City of Oslo has taken a lead.

### Efficient logistics systems enable the transition to zero and low-emission solutions

New technology has contributed to a reduction in emission intensity in the transport sector, but an increased scope of transport means that overall emissions have not declined. There is therefore a need to develop technology and solutions to streamline the overall scope of transport. Digitalisation and autonomy will enable a transport system with a better connection between means of transportation, infrastructure and users. This will be important for coordinating the transport system and will yield results in capacity utilisation and efficiency in existing transport.

Enova will contribute to the demonstration of new efficient logistics solutions and building knowledge that can contribute to efficiency in future transport systems, as well as knowledge about what they will require as regards changes to established practices, collaboration and coordination between stakeholders.

In 2019, Enova supported one pilot project within new logistics solutions to DB Schenker, which aims to ensure 80 per cent emission-free distribution of goods in Oslo inside Ring 3. This project involves considerable investments in new electric delivery trucks, new electric bicycles and a central logistics terminal – Oslo City Hub.

Pilot and demonstration projects are important in order to verify that the concepts work and will build the market players' knowledge and experience. Emission-free construction sites was a focus area in 2019 in Pilot-E, the collaborative effort between the Research Council, Innovation Norway and Enova. One of the projects awarded support was Data-driven construction site, which includes new logistics solutions. Here, a consortium led by Skanska will achieve a considerable emissions reduction by optimising driving patterns, coordinating and allocating the fleet of machinery with the aid of artificial intelligence. This project will enable reduced emissions at existing facilities and will simultaneously blaze a trail for future autonomous and zero-emission construction sites when the

technology for this is ready. The solution developed will be made available to other contractors as well, and will thereby have an impact beyond Skanska's own activities.

## Functioning market for biogas and biofuels

Sustainable bioresources with good climate effect are, and will remain, a scarce resource leading up to the low-emission society. This is why it is important to utilise the bioresources as efficiently as possible. The use of sustainable bioresources could potentially yield considerable reductions in emissions from industry and transport, and could also provide a basis for new industries.

Enova will contribute to technology development to produce advanced biofuels and stimulate further development of the

value chain for biogas by supporting biogas production facilities and purchasing commercial vehicles with associated filling infrastructure.

No support was awarded for biogas production facilities in 2019. These projects are often few in number, but large in scope, so it is natural for some time to pass without new projects.

Enova awarded support to 20 large biogas vehicles, lorries and waste collection vehicles last year. The increasing number of projects in biogas lorries is producing more knowledge about the benefits and challenges associated with using the vehicles. We are experiencing an increase in the number of vehicle suppliers, and at least two are now increasing the volume of vehicles they can deliver.

# Industry



In a low-emission society, industrial production will have to be emission-free, based on renewable energy and use significantly less energy per manufactured unit than is the case today. Some of this can be realised by utilising known technology, but much will also depend on developing and qualifying new technology for the market.

More than a gradual technology development will be needed in order for industry to be able to reduce its emissions toward zero. Several sectors are dependent on technological revolutions that radically change production processes.

## Demonstrate technologies for low and zero emissions process industry

As the process industry reduces its emissions leading up to 2050, this will have to take place by implementing both new process technology and efficiency measures. Zero-emission industry will also require establishing infrastructure to transport and store CO<sub>2</sub> where there are no zero-emission alternatives, such as in the production of cement.

Enova is prioritising the development of new process technology that does not lead to greenhouse gas emissions, as well as process technology that enables renewable input factors where carbon is a necessary part of the process.

In 2019, Enova awarded a total of NOK 132 million in support for three projects in this category. These projects have contributed to more knowledge and increased focus on zero-emission technology both for the companies themselves and for technology suppliers.

REC Solar received NOK 118 million of this to realise a new process based on wafer fines (kerf) as raw material, including NOK 8 million in pre-project support. Two other companies received support to pilot new technology in a scaled-down size, with this support totalling NOK 15 million.

Technology development timelines in industrial process technology are long and capital-intensive. This is particularly the case where new processes must be developed or where greenhouse gas reductions entail a considerable intervention in the production process. Enova therefore does not expect a high number of projects each year, but we nevertheless found activity to be lower than desired in 2019.

## Demonstrate and introduce energy-efficient technologies and solutions for renewable energy consumption in industry

The development of automation and digitalisation technology are strong drivers for energy-efficient technologies and solutions for renewable energy consumption in the industry, and enable the emergence of new products, value chains and business models. Heat pumps are being used at increasingly higher temperatures, and we are seeing a rising trend in the direction of electrification or using renewable fuels in new areas.

In 2019, Enova supported 29 projects that demonstrate energy-efficient technologies and solutions for renewable energy consumption in industry, with support totalling NOK 766 million. NOK 195 million of this was awarded as a conditional loan to NorSun, linked to realising a demonstration plant to produce larger, thinner wafers for highly efficient solar cells with high ingot utilisation.

These projects help trigger significant investments in the industry which will strengthen the focus on energy-efficient technology projects. They also contribute to a boost in competence within efficiency measures supported by digitalisation both in the industry itself, and in technology suppliers and the consultancy sector. In addition to the process industry, the Norwegian food industry can also be emphasised as particularly forward-leaning as regards the use of innovative and energy-optimised solutions.

Interaction between electric and thermal solutions, as well as energy storage, are trends we expect to continue.

Enova can also contribute to more rapid cost development and familiarity in the market for select, more familiar technologies with the potential to reduce and replace fossil fuels. In 2019, Enova had thematic efforts associated with utilising waste heat, as well as phasing out fossil energy for heating purposes, mechanical work processes and energy supply for feeding fleets in the aquaculture industry.

Within waste heat utilisation, Enova supported 14 projects which, in total, will reduce primary energy consumption by 34 GWh. We experienced a rising number of applications for this in 2019.

Within aquaculture, Enova supported 63 projects to connect feeding fleets to onshore power, which will help phase out an annual consumption of 5–6 million litres of diesel. The development Enova has contributed to has caused multiple power companies and technology suppliers to establish new departments to specifically focus on onshore power for fish farming as a business area. This is likely to contribute to further cost reductions, which will facilitate full electrification of the aquaculture industry over time.

## Energy system



A renewable, competitive and resilient energy system is decisive in order to succeed with transport and industry tailored to a low-emission society, and to utilise renewable resources.

One important factor for security of supply in the power system is the development in peak demand. This demand is decisive for capacity needs, and thus also for grid investments. Flexibility in the form of alleviating demand and utilising flexibility from grid customers could therefore be an important source of limiting costs at all grid levels. By utilising flexibility on the consumption side and utilising the flexibility in storage solutions, costs can be reduced and efficiency can be increased over the short and longer term in the power system.

### A well-functioning market and solutions for flexibility

Enova prioritises working toward flexibility solutions that help reduce the need for energy and peak demand. This includes developing technology and business models that stimulate the utilisation of latent flexibility resources, better efficiency and storage.

The award of NOK 210 million to eight projects for large-scale demonstration of the future energy system was important for Enova to drive new flexibility solutions.

There was significant interest from the market and strong competition for these funds. The Norwegian Energy Regulatory Authority in the Norwegian Water Resources and Energy

Directorate (NVE) has been part of the resource team, both in designing the programme and assessing projects.

The projects that received support have led to collaboration across disciplines and sectors, emphasising technological and commercial innovation. The demonstration projects provide experience with and increase competence in storage options, a marketplace to purchase and sell flexibility, load balancing, alleviation from thermal systems, management systems, digitalisation and local production.

The district heating sector is in need of innovation, and increased interaction between district heating and the power system will be important in order to better utilise flexibility in the energy system and use resources in the most efficient way possible. In 2019, Enova supported 18 projects within thermal storage, converting fossil energy carriers and major infrastructure projects. Kvitebjørn Varme is leading the way by utilising new, innovative solutions in a project that led to Tromsøya island achieving a fully-developed district heating network with the opportunity to store heat seasonally.

There is a positive development in the district heating sector. New investments were made in 2019 totalling more than NOK 1.2 billion, doubling the amount from previous years. These projects received support from Enova. However, profitability has improved in the district heating sector since 2016. We are seeing increasingly larger investments taking place without government support.

## Buildings and homes



Buildings is the sector that uses the most energy in mainland Norway, and there is still a considerable potential for conversion to renewable energy in existing buildings. Reduced energy and

demand consumption in buildings can reduce the need for new power generation and transmission capacity that would otherwise be needed to electrify sectors such as transportation

and industry. Direct emissions from the operations phase for non-residential buildings and property are very low in Norway. However, the sector contributes to considerable emissions in construction processes, as well as significant indirect greenhouse gas emissions through the production of new building materials.

### **A well-functioning market for climate-friendly construction processes and materials**

Climate-friendly construction processes, reusing materials and ensuring that newly produced materials have a low carbon footprint are important in order to reduce direct and indirect greenhouse gas emissions in buildings.

There is currently a lack of knowledge surrounding emissions from construction processes and material consumption on both the supply and demand sides. This applies both as regards cost, procurement, implementation, availability and quality requirements. Neither are there any regulations covering greenhouse gas emissions associated with material consumption.

Enova wants players to choose climate-friendly construction processes and materials in both new construction and rehabilitation. This requires demonstration of new technologies, construction processes, business models and marketplaces.

In 2019, Enova awarded support to two projects aimed at testing new business concepts and forms of cooperation associated with reusing building materials, with the aim of establishing marketplaces for this. These projects help ensure that multiple large stakeholders are building new expertise and experience.

Enova is also stimulating the market to examine the possibility of reusing materials through concept studies, which gives the principal/developer a better basis for choosing climate-friendly materials and energy solutions.

In 2019, Enova awarded support to the project *Energipartner til utslippsfrie byggeplasser* (Energy partner for emission-free construction sites), which is a Pilot-E project led by BKK AS. Here, businesses throughout the value chain will cooperate to realise an emission-free construction site in practice. The project will investigate whether or not there is a basis for a new commercial market player, an "energy partner" that will play a unique role in the interface between power grid companies and other players in the construction processes.

### **A well-functioning market for services that trigger demand and energy measures in buildings**

The potential to reduce energy consumption in buildings is considerable, but measures that are both available and profitable nevertheless remain unrealised. A lack of energy expertise with building owners, modest financial gains both for the individual lessee and building owner, combined with the fact that rehabilitations and renovations often lack a comprehensive plan for the

building's energy quality, are barriers that must be reduced in order to trigger the energy savings potential.

Enova believes that this potential can be triggered by developing a service market with third-party stakeholders. This presumes an increased willingness for innovation among players and new business concepts, contract forms and models for cooperation.

In order to contribute to this development, where multiple stakeholders cooperate and develop new business models, support was awarded in 2019 to nine projects representing a broad spectrum. One example is Hantho Energy AS, which received support to develop a new business model where the advisor guarantees an energy reduction. In another project, *Energitjenester AS* has studied a concept to provide electric vehicle charging in housing cooperatives and jointly-owned properties.

In an effort to increase the number of potential projects and increase competence with building owners and advisers, Enova also provides support for comprehensive mapping, which gives building owners and tenants a better basis for making decisions. In 2019, 38 projects received support to map 1.4 million m<sup>2</sup> of non-residential buildings and 13 housing cooperatives. Close to half of these stakeholders have decided to proceed with investments in concrete measures. Projects are required to engage an advisor to implement mapping.

Potential projects and expertise from advisers are needed to get the market started, and an increase in the number of mapped projects in 2019 is a step on the road toward establishing a well-functioning market for energy services.

### **High energy ambitions are normal when buildings are rehabilitated**

The potential for energy efficiency measures in existing buildings is considerable. Enova will motivate market players within rehabilitation, retrofits and extensions (ROT) to raise energy ambitions both as regards building structures and future operations.

As regards non-residential buildings, Enova supports choosing the best available technology in upgrades of existing buildings. Stringent energy efficiency requirements are set, with the aim of making the best products and solutions a default choice.

In 2019, funding commitments were given for 1 770 measures, distributed across 180 projects in the market for commercial buildings. The two most popular measures were improving building insulation properties and establishing a system for detailed energy follow-ups.

The number of private small homes with high energy ambitions has been increasing every year since 2013. In 2019, a total of 733 homeowners received grants to hire consulting expertise to create an energy plan for their rehabilitation project. In an

evaluation from 2019, NTNU Samfunnsforskning<sup>2</sup> concluded that there is now a market for energy consultancy in many parts of Norway, and that Enova appears to have contributed to this. Enova has also contributed to increase both the scope and quality of the energy upgrades. A change is emerging in the market, but there will be a need for additional efforts to ensure further development and that the effect in the market is permanent.

Enova has also, in collaboration with the Sintef project OPPTRE, started an effort aiming to develop methods for cost-effective upgrades with high energy ambitions. Today, there are few industrialised solutions for energy upgrades in older homes. Glavatech has developed a system which, through industrialisation, could change the current traditional way we upgrade and add insulation to old homes. Enova has supported testing of this in ten select Norwegian homes in a pilot project, where adapting the system to different types of homes and geographical factors are in focus. The project will specifically test the market's acceptance of the system, as well as all processes associated with implementing future individual projects.

### Complete transition from fossil fuel oil to energy-flexible alternatives

Between 50 and 80 per cent of energy consumption in homes is associated with heating. Energy consumption is greatest on the coldest days, and this is when the strain on the Norwegian power grid is highest. As of 2020, use of fossil fuel oil for heating in homes and buildings is prohibited. If the fuel oil had been

replaced with direct-acting electricity, this would have resulted in substantially higher strain on the power grid, particularly when loads are already at record-highs. This is why it's important for the heating systems replacing oil furnaces to be flexible and able to use other forms of energy than direct-acting electricity. It is also an advantage if the systems can accumulate heat so that the heat supply can be stopped periodically without this coming at the expense of comfort. The possibility of using locally stored energy, such as pellets and wood, can also ease the strain on the power grid during potential peak periods.

In order to influence the market to choose this type of solution, Enova introduced grants for heat pumps, bio heating and connecting to district heating systems. Supplier capacity was identified as a key challenge. This is why Enova raised grant levels in 2018, and simultaneously announced a gradual tapering leading up to 2020. This resulted in a strong increase in demand for alternative heat sources, particularly heat pumps. Between 2017 and 2018, total sales of heat pumps in Norway were up 25 per cent to about 100 000 units sold. Air-to-water and liquid-to-water heat pumps, which usually replace oil boilers, increased the most, by a factor of 50 and 40 per cent, respectively. This increased demand continued in 2019.

Enova has contributed to a strong increase in demand for alternative heat sources and has facilitated an increase in capacity in the supplier industry leading up to the prohibition. Enova considers the goal of transitioning from fossil fuel oil to energy-flexible alternatives achieved.

## Goal indicators

### – contributions from the 2019 results

2019 has been a year of high activity, and Enova has achieved good results.

Enova invests in projects that, based on what we know today, are best suited to stimulate the desired market changes. In 2019, Enova received more than NOK 3.2 billion and has granted support amounting to more than NOK 5.2 billion to about 1 500 energy and climate projects. We have also supported more than 20 000 individual measures in Norwegian homes through the Enova Subsidy, a scheme that reimburses homeowners for a share of the expenses of investing in energy-smart solutions in their homes.

Enova's management agreement uses select goal indicators as one of multiple criteria to assess goal achievement. The following level is presumed for the performance indicators for the agreement term 2017–2020:

- climate results corresponding to 1 million tonnes of CO<sub>2</sub> equivalents in sectors not subject to emission credits
- energy results corresponding to 4 TWh
- reduced peak demand results corresponding to 400 MW
- innovation results corresponding to triggered innovation capital of NOK 4 billion

In 2019, Enova has recorded 0.31 million tonnes of CO<sub>2</sub> equivalents in climate result, 2.1 TWh in reduced energy consumption, 177 MW in reduced peak demand and triggered NOK 5.7 billion in private innovation capital. Enova assesses its results in 2019 as good for all goal indicators, measured against contractual levels, three of which have already surpassed this level at the end of 2019. Table 3.1 shows results for the four goal indicators for 2017, 2018 and 2019.

<sup>2</sup> <https://samforsk.no/Sider/Publikasjoner/Evaluering-av-Enovas-satsing-på-oppgradering-av-eksisterende-boliger.aspx>

**Table 3.1**

Goal indicator results 2017–2019

Goal indicator	2017	2018	2019	Totalt
Climate result (ktonnes CO <sub>2</sub> equiv.)	274	226	309	809
Energy result (GWh)	1 643	1 474	2 065	5 182
Reduced peak demand (MW)	128	117	177	422
Triggered innovation capital (NOK million)	1 639	1 159	5 720	8 518

**Table 3.1:** The table shows results for the four measurement indicators, defined in the agreement with the Ministry of Climate and Environment, for projects awarded support during the 2017–2019 period. The figures have been corrected for cancelled and final-reported projects as of 2019.

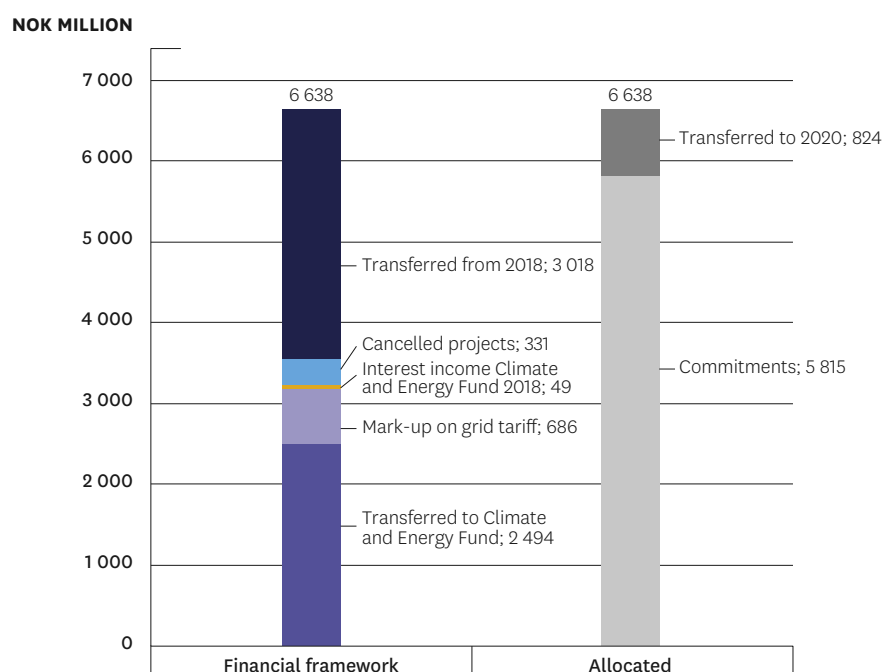
## The Climate and Energy Fund – allocation and further development 2019

New funds are added to the Climate and Energy Fund every year. The revenues come from appropriations via the fiscal budget, a mark-up on the grid tariff and interest income from the resources in the Fund. These revenues amounted to more than NOK 3.2 billion in 2019. Enova can also allocate funds transferred from previous years, as well as returned funds from cancelled projects.

These items constituted just under NOK 3.4 billion in 2019. Enova thus had an overall framework of NOK 6.6 billion in 2019. In addition, Enova has been able to grant funding commitments totalling up to NOK 400 million beyond the available resources in the Climate and Energy Fund, pursuant to the commitment authorisation.

**Figure 3.5**

Allocation of Climate and Energy Fund grants 2019



**Figure 3.5:** The figure is a presentation of the Climate and Energy Fund's various sources of revenue and how revenue is managed. Projects approved and cancelled in 2019 are not included in liabilities and cancelled projects.



The financing of the Climate and Energy Fund provides both market players and Enova with predictability in the long-term work of realising the transition towards a low-emission society.

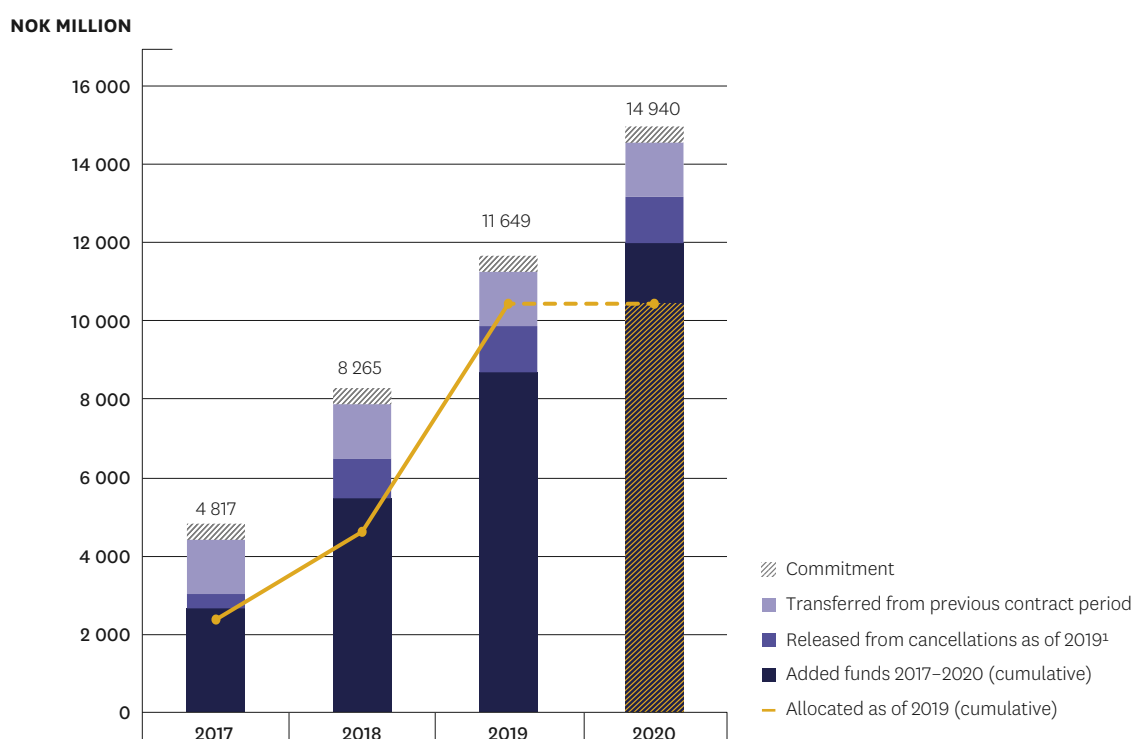
Enova's ability to transfer unused funds from one year to the next is one of Climate and Energy Fund's strengths. This provides a flexibility that is particularly important for major, capital-intensive individual projects. These are projects where Enova normally maintains a close dialogue with the players for a long time prior to an application, but where it is often difficult to predict with any certainty when the projects are ready for a support decision. Major energy and climate projects often have a long project development timeline.

The opportunity to transfer funds gives the players assurance that the time of application and decision will not impact the outcome of the case processing.

Appropriations to the Climate and Energy Fund were increased to NOK 2 billion for the present contractual term. NOK 1 billion was also added to the Climate and Energy Fund for the 2018–2020 period through the supplemental agreement, earmarked for establishing a zero-emission fund for commercial transport. Figure 3.6 shows an overview of allocated funds in 2017–2019, and the development in expected available funds for the entire contract term 2017–2020.

**Figure 3.6**

Allocations of expected available funds in the Climate and Energy Fund 2017–2020



**Figure 3.6:** The figure shows an overview of allocated funds from the Climate and Energy Fund in 2017–2019, as well as the expected development (cumulative) in available funds in the Climate and Energy Fund during the 2017–2020 period. Added funds in 2020 is in accordance with the fiscal budget.

<sup>1</sup> Funds released from cancelled projects approved in previous contract periods.

Enova has granted funding commitments amounting to NOK 5.6 billion to projects in 2019. These projects are expected to trigger close to NOK 10 billion from the market. This will yield a total investment of more than NOK 15 billion in projects approved in 2019.

Support totalling about NOK 2.9 billion was awarded in 2019 for projects that further develop the energy system, which amounted to about one-half of the total allocated funds. These projects accounted for more than one-half of the triggered investments for technology development; Equinor's offshore wind project Hywind.

Tampen was the dominant project. Projects in this sector also represented more than 70 per cent of the reduced peak demand, and projects developing district heating provide particular contributions toward strengthening Norway's security of supply by reducing peak demand in the power grid on the coldest winter day.

Support totalling more than NOK 1 billion was awarded to 155 industry projects in 2019, which amounted to 19 per cent of overall support. The industry projects supported in 2019 provide very good contributions toward all goal indicators. This sector is the largest contributor to climate and energy results.

Support totalling about NOK 1 billion was allocated for 841 projects within the transport sector in 2019. This accounts for about 18 per cent of total allocations. The number of transport projects has increased substantially due to the support scheme for purchasing electric delivery trucks which was launched in 2019. Transport is the sector with the greatest potential for implementing climate measures outside the sector subject to climate credits. Transport projects account for about 40 per cent of the climate results in 2019, and also contribute good results within energy and innovation.

Within non-residential buildings and property, Enova supported 246 projects with NOK 323 million. This amounted to six per cent of Enova's support in 2019. The majority of this support was used to upgrade to the best available technology in existing buildings. The individual projects in buildings are small, but results here contribute as regards security of supply and somewhat as regards innovation.

Households and consumers is an important sector for creating broad-based involvement and a focus on implementation of energy and climate measures. It is also important in an energy system perspective to develop the interplay between energy system, transport and buildings. This sector is characterised by many small projects, and contributes both energy and climate results. The most important work here is the Enova Subsidy, which constitutes about six per cent of allocated funds in 2019. This rights-based grant scheme for homeowners is progressing well, and with about 21 000 grants in 2019, the number of grants has increased by 44 per cent from the previous year. Disbursements have increased from NOK 275 to 334 million. A fully-digital application process makes it easy for homeowners to register measures and receive grants. User surveys show that users are very satisfied with the programme.

About NOK 240 million is linked to annual administration contribution for Enova for the management of the Climate and Energy Fund and other contractual activities.

**Table 3.2**  
Climate and Energy Fund's allocations

Sector/activity	2017	2018	2019	Total
	NOK million	NOK million	NOK million	NOK million
Industry	423	397	1 054	1 873
Transport	927	780	998	2 706
Energy system	190	158	2 869	3 217
Non-residential buildings and property	416	407	323	1 146
Households and consumers	165	275	334	773
International	2	4	1	8
Consultation and communication	53	44	48	145
External analyses and development measures	38	20	29	87
Administration contribution	157	155	159	470
<b>Total</b>	<b>2 371</b>	<b>2 239</b>	<b>5 815</b>	<b>10 426</b>

**Table 3.2:** The table shows funds allocated from the Climate and Energy Fund during the 2017–2019 period distributed by sector as well as other contractual activities and administration contribution. The figures have been corrected for cancelled and final-reported projects as of 2019.

## Activity overview

Table 3.3 shows an overview of all applications in 2019, including the Enova Subsidy. A total of 21 184 applications were received in 2018, and 22 273 projects were supported. These figures represent increases of 20 and 40 per cent, respectively, from the previous year. In certain instances, there could be more decisions than applications for a programme over the year. This is because applications that are received at the end of the year could be fully processed in the following year.

When applications do not receive support, this is usually due to one or more of the following causes:

- The projects are too profitable to receive support.
- The projects are too expensive to receive support.
- The projects do not fulfil the criteria for support.
- The projects are not sufficiently documented.

**Table 3.3**

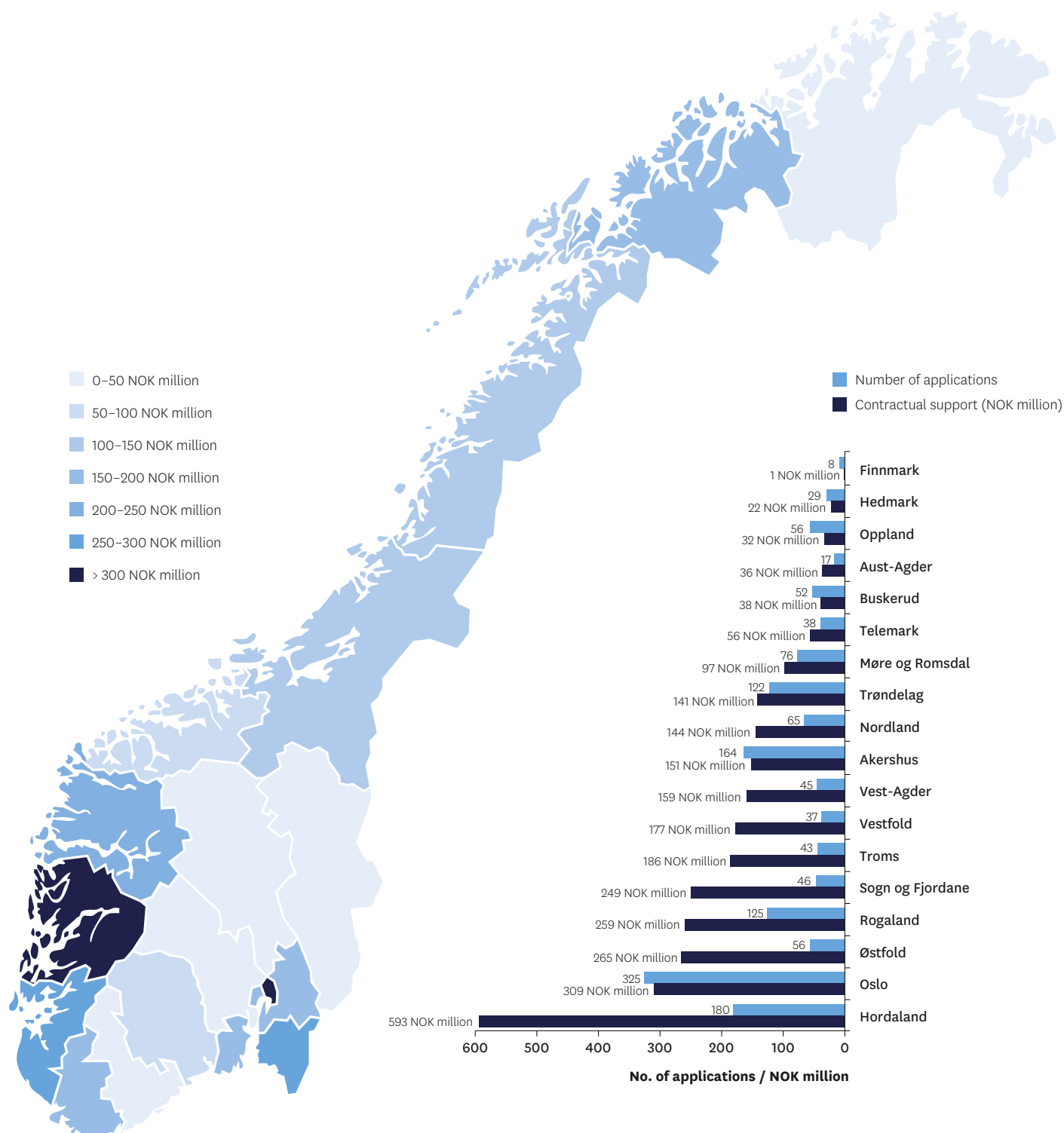
Activity overview for the Climate and Energy Fund 2019

Sector	No. of applications	No. of projects supported	Contractual support
			NOK million
<b>Industry</b>	<b>157</b>	<b>155</b>	<b>1,054</b>
Full-scale innovative energy and climate technology	23	23	622
Demonstration of new energy and climate technology	1	2	215
Energy and climate efforts in industry	120	81	106
Support for energy and climate measures in industry and plants	-	15	42
Pre-project support for new energy and climate technology in the industry	7	5	38
Pilot testing of new energy and climate technology in industry	5	4	24
Support for introducing energy management	-	25	7
<b>Transport</b>	<b>953</b>	<b>841</b>	<b>998</b>
Electrification of maritime transport	51	34	375
Support for infrastructure for municipal and county authority transport services	8	9	220
Full-scale innovative energy and climate technology	12	5	181
Zero-emission fund for electric delivery trucks	712	711	95
Onshore power for ships in Norwegian ports	24	10	87
Support for energy and climate measures in ground transport	43	19	26
Support for charging infrastructure for electric cars (rights-based)	47	24	7
Pilot testing of new energy and climate technology in industry	3	1	5
Support for introducing energy management	-	5	3
Zero-emission fund – charging for electric delivery trucks	27	23	0.1
Demonstration of new energy and climate technology	1	-	-
Hydrogen infrastructure	6	-	-
Area development for charging infrastructure for electric cars	4	-	-
Support for production of biogas and biofuel	15	-	-
<b>Energy system</b>	<b>327</b>	<b>240</b>	<b>2,869</b>
Full-scale innovative energy and climate technology	7	8	2,382
Large-scale demonstration and pilot project unit	-	8	210
District heating and district cooling	57	18	210
Heating plants	191	166	37
Support for concept assessment in new construction and areas	68	38	27
Pilot testing of new energy and climate technology in the energy system	4	2	3
<b>Non-residential buildings and property</b>	<b>424</b>	<b>246</b>	<b>323</b>
Best available technology in existing buildings	333	180	247
Introducing new technology in buildings and areas	28	13	51
Commercial testing	7	6	12
Innovative solutions in the energy service market for buildings	18	9	8
Comprehensive mapping of buildings	38	38	5
<b>Households and consumers</b>	<b>19,318</b>	<b>20,789</b>	<b>334</b>
Enova Subsidy	19,318	20,789	334
<b>International</b>	<b>6</b>	<b>2</b>	<b>1</b>
IEA Main Project	6	2	1
<b>Total</b>	<b>21,184</b>	<b>22,273</b>	<b>5,580</b>

**Table 3.3:** The table shows an overview of the number of applications received and number of projects approved for support<sup>1</sup>, as well as funds awarded within Enova's programmes in 2019. The table only shows support for eligible programmes, and not allocations for other contractual activities in the Climate and Energy Fund. As of 2019, the programme Support for concept assessment in new construction and areas is reported under the Energy system sector (previously reported under non-residential buildings and property).

<sup>1</sup> Number of projects approved for support has been corrected for cancellations. This applies to 34 projects for the 2019 portfolio.

# County distribution of projects



In 2019, Enova supported more than 1 480 projects with a total of NOK 5.2 billion<sup>1</sup>. An overview and more information about these projects can be found at [www.enova.no](http://www.enova.no)

<sup>1</sup> One project on the continental shelf (Equinor's offshore wind project with NOK 2.3 billion in awarded support) and the Enova Subsidy (NOK 334 million) are not included in the map presentation.

# Status of project portfolio

When Enova decides to award support for projects, the amounts are earmarked in the Climate and Energy Fund as commitments. The relevant amount is then disbursed in arrears based on actual project costs. When a project has progressed to the point where disbursement from Enova starts, it will have passed many critical decision points and the risk of the project being cancelled declines substantially.

Figures 3.7 and 3.8 show the status of the project portfolio measured in number of projects and support granted, respectively. Figure 3.7 shows that 15 per cent of the projects supported in 2019 have already been completed, and have submitted final reports to Enova. However, Figure 3.8 shows that the approved support for these projects constitutes a small amount, much less than one per cent of the overall support approved in 2019. This is natural, since it is the smallest projects that can be completed during the same year that they received support from Enova.

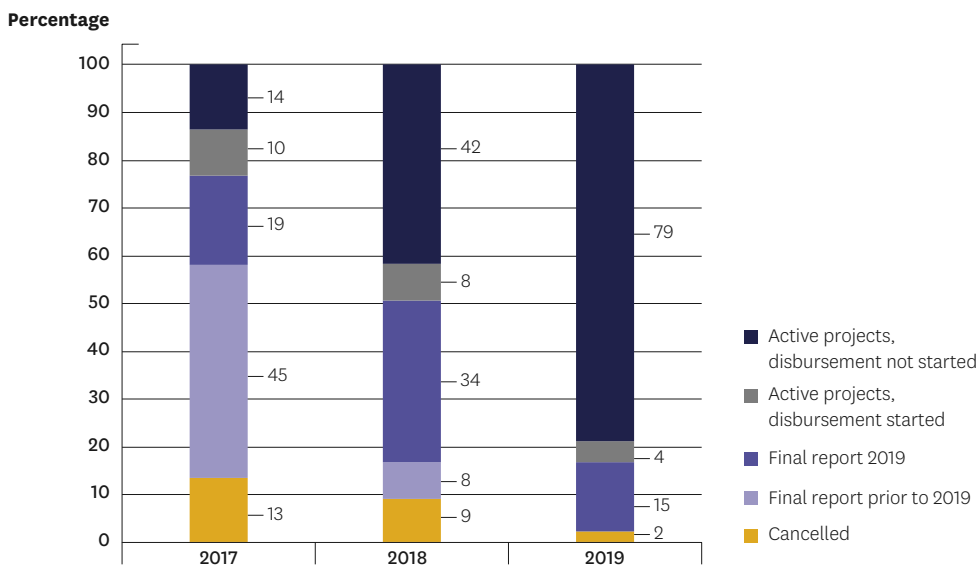
Most projects are active. This means that a support decision has been made and that the project is not finalised. At the end of the year, this group constitutes more than 80 per cent of the number of projects in the 2019 project portfolio, but more than

99 per cent of the support. Some of the projects that receive support are cancelled, often due to changed preconditions during the period from when the application was submitted until the start-up decision. A certain number of cancellations is both expected and desired because Enova must take certain risks, but avoid overcompensating projects, which means that some projects naturally will not be realised. We must expect that cancellations will occur in the portfolio in the upcoming year as well. The support earmarked for the project is then released for use in new projects.

From the 2018 portfolio, 42 per cent of projects were finalised by the end of 2019, while 64 per cent of projects from 2017 are finalised. Nevertheless, these projects only represent 10 and 30 per cent, respectively, of awarded support in 2018 and 2017, so the finalised projects are small. Investment decisions and start-up of the largest projects take a long time. 42 per cent of the number of projects from 2018 are active without disbursement having started, and these projects account for about 45 per cent of support awarded in 2018. Nearly five of six projects approved in 2017 have either been finalised or have received disbursement.

**Figure 3.7**

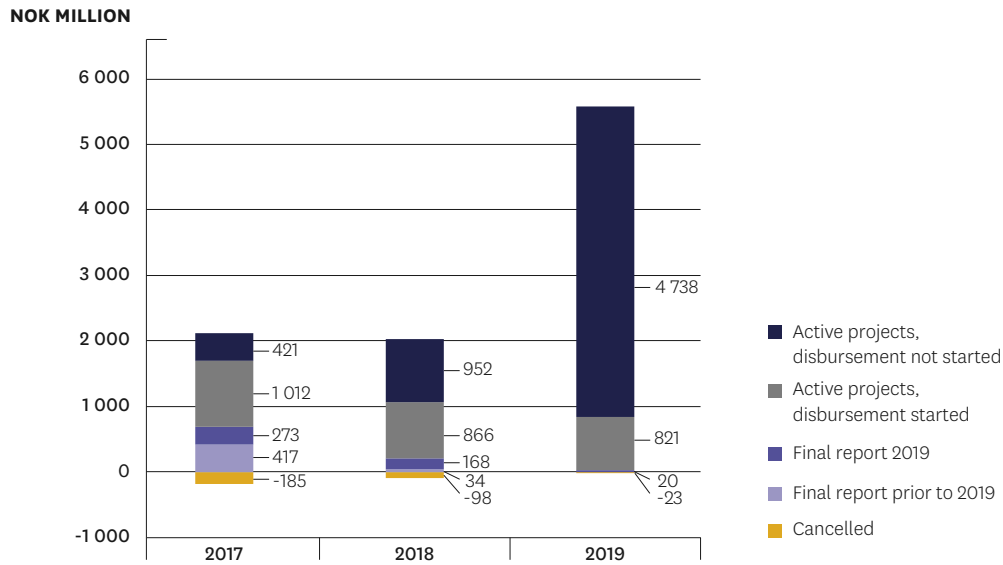
Status of project portfolio, measured in no. of projects



**Figure 3.7:** The figure shows the percentage of final-reported, active and cancelled projects at the end of 2019, measured in the number of projects. The figure also shows the percentage of projects where disbursement has started.

**Figure 3.8**

Status of project portfolio, measured in contractual support



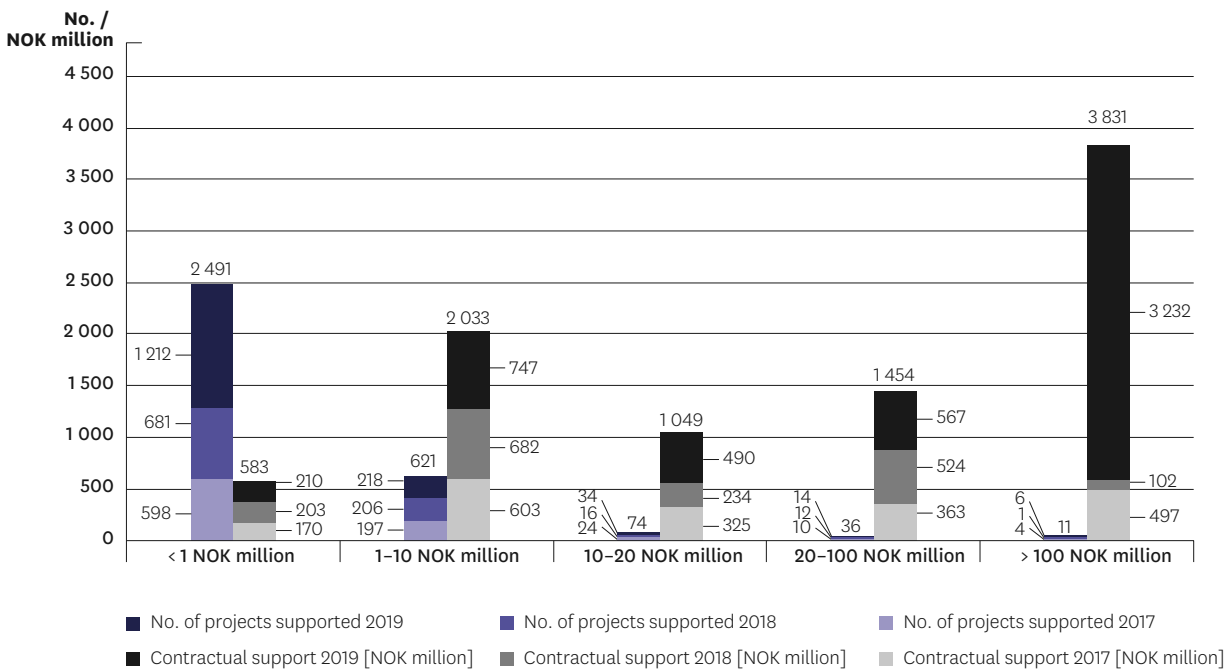
**Figure 3.8:** The figure shows final reported, active and cancelled projects at the end of 2019, measured by awarded support.

Figure 3.9 shows a distribution of the project portfolio according to the size of support granted. Most projects are awarded less than NOK 1 million, but these smaller projects make up a relatively small share of allocated funds. So far in the agreement period, 77 per cent of projects have been awarded less than

NOK 1 million, and these only account for 7 per cent of total awarded support. About 4 per cent of the projects were granted more than NOK 10 million in support, and these amount to more than 70 per cent of the total support.

**Figure 3.9**

Projects 2017–2019 distributed by contractual support



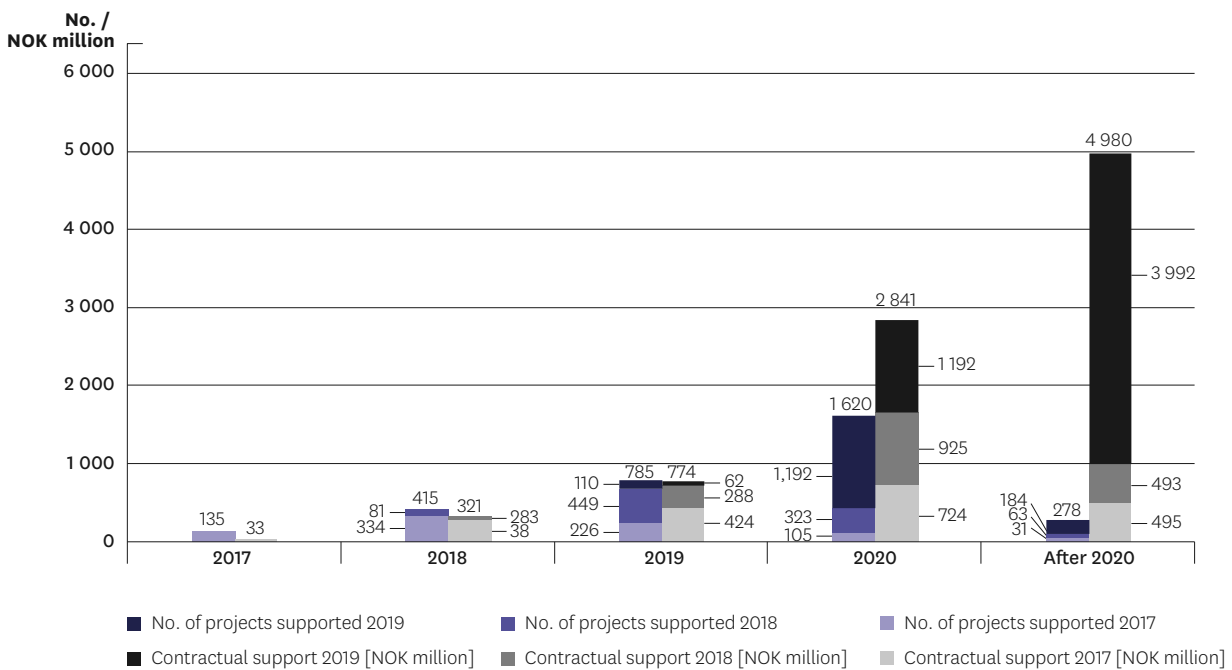
**Figure 3.9:** The figure shows a distribution of projects that were granted support in 2017–2019 grouped according to funding level. The Enova Subsidy is not included in this overview.

Figure 3.10 shows a distribution of the project portfolio according to contractual end date. There is a correlation between the size of the project and its implementation time. Small projects normally have a much shorter implementation time than large projects. Small projects are usually related to smaller measures in buildings and industry or procuring vehicles, while the large projects involve significantly more engineering and investments in physical measures. Naturally, these require more time to complete.

Nearly 56 per cent of the support funds has been granted to projects that take longer to complete and will not be completed until 2021 or later. This represents a small number of projects, less than nine per cent. Enova is concerned with ensuring that projects that receive support follow a set and realistic schedule for project implementation. The implementation time can affect the risk of external factors changing for the project, and thus affect the risk of implementation.

**Figure 3.10**

Projects 2017–2019 distributed by contractual end date



**Figure 3.10:** The figure shows a distribution of projects started in 2017–2019 distributed according to contractual end date for the projects. The Enova Subsidy is not included in this overview.

## Activities

### Enova Subsidy

Enova has granted support to more residential projects in 2019 than in previous years. In total, almost 21 000 grants were disbursed last year, an increase of more than 40 per cent. As of 2020, use of fossil oil for heating is prohibited. Through the Enova Subsidy, homeowners could receive support for removing oil burners and oil tanks in 2019 while switching over to a heating solution based on renewable energy sources. 2 552 grants were awarded to remove oil stoves and oil tanks. More than 2 800 homeowners also received grants to remove oil tanks combined with purchasing another renewable heating source, such as a heat pump. This means that about 5 400 homeowners received grants in 2019 for removing oil tanks. This was the most popular single measure in 2019.

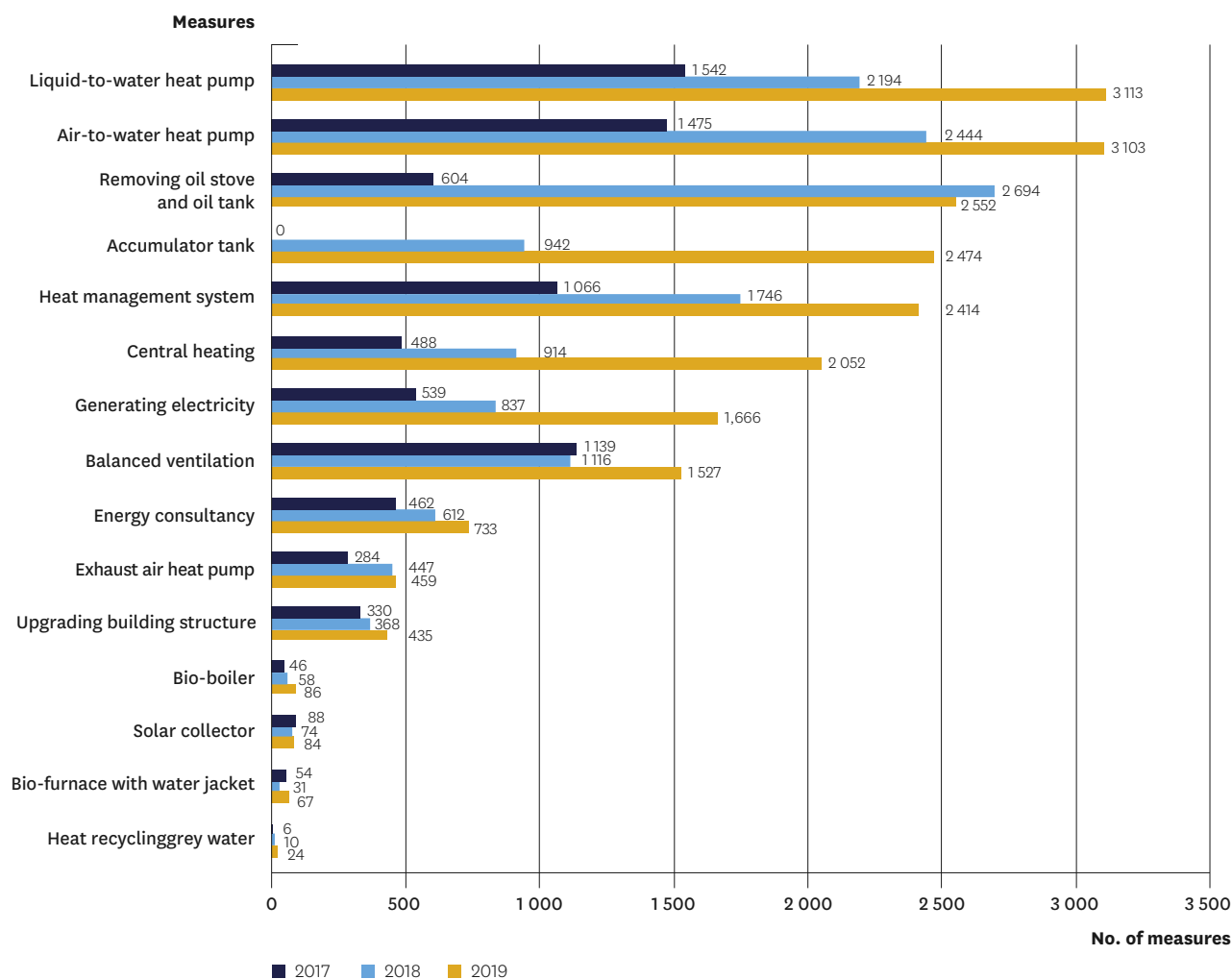
After that, the other most popular single measures were installing liquid-to-water heat pumps and air-to-water heat pumps, which together accounted for 30 per cent of grants.

Figure 3.11 compares the number of grants in 2017, 2018 and 2019. The ranking of measures is relatively similar for each year. One exception is installation of accumulator tanks, which was a new measure in 2018. This is the fourth most popular measure in 2019.

The most extensive and energy-conserving single measure is upgrading the building structure. 435 such grants were disbursed in 2019, which is an 18 per cent increase from 2018.

**Figure 3.11**

No. of grants within the Enova Subsidy, distributed by measure



**Figure 3.11:** The figure shows the number of subsidies within the Enova Subsidy in 2017–2019, distributed according to measure. 2 848 households that received reimbursement for conversion to a heat pump, bio-boiler or bio-furnace also received subsidies for removal of oil boilers and tanks in 2019. The corresponding figures for 2018 and 2017 were 2 588 and 1 044, respectively.

## Nationwide information services

**Table 3.4**

Nationwide information services

Activity	Purpose of activity	2017	2018	2019
Ask Enova	Nationwide information and consultation via telephone, e-mail and online chat to support the objectives of the Climate and Energy Fund.	58 609	79 805	62 398
Private individuals		43 573	64 754	48 942
Commercial players		15 036	15 051	13 456
Enova.no (page views per day)	Information about Enova's services and consultation concerning energy and climate measures.	9 681	11 737	10 901
Enova Subsidy (private market)		3 754	6 807	6 368
		5 927	4 930	4 533

**Table 3.4:** The table shows the number of inquiries to Ask Enova and number of page views per day for Enova's website in the 2017–2019 period.



Enova provides advisory services for both commercial players and private individuals. For private individuals, there is a focus on the need to acquire information at an early stage in the decision phase before a project, as well as assistance with the actual application process. The advisory services are provided through a dedicated website and through the Ask Enova service.

Ask Enova received over 60 000 inquiries in 2019. This is a decline of about 20 per cent compared with the previous year. The primary reasons for this are a decline in the number of questions regarding the oil furnace phase-out, as well as general streamlining of the service. Table 3.4 shows that inquiries from

private individuals account for the majority of the decline, but the number of inquiries from commercial players has also declined. This is also true for use of the website. The number of page views in the private market and for the commercial part was down five to ten per cent from 2018 to 2019.

Enova safeguards the operation and development of the Energy Certification Programme and programme for energy assessment of technical facilities. The goal of the programme is to provide relevant and well-facilitated information about energy standards and potential energy efficiency measures. The programme aims to be a useful tool for players in the construction sector.

## Performance indicator for climate

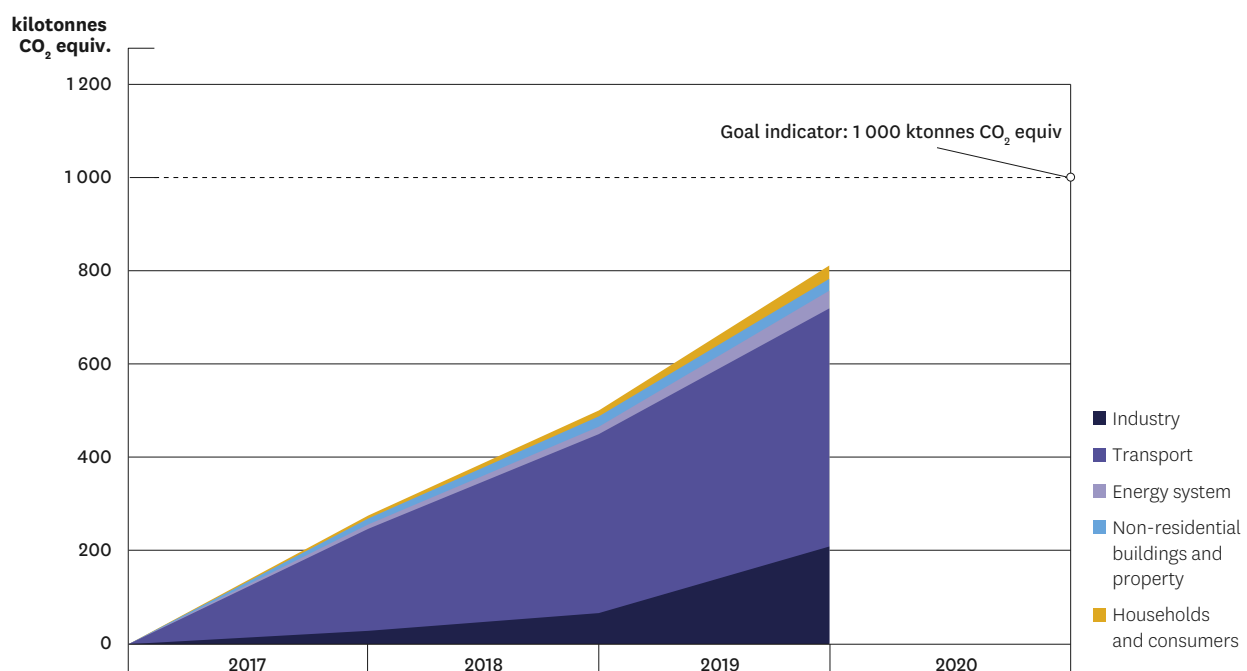
Enova shall promote the reduction of greenhouse gas emissions that helps fulfil Norway's climate commitment for 2030.

**The climate result** is the sum of changes in greenhouse gas emissions not subject to carbon credits as a result of various measures in the projects which Enova has supported. The calculation uses emission coefficients for the different energy carriers involved as a basis. The climate result is measured in tonnes of CO<sub>2</sub> equivalents per year. The conversion to tonnes of CO<sub>2</sub> equivalents takes place using internationally recognized GWP factors (*Global Warming Potential*).

In 2019, Enova supported projects that are expected to reduce emissions not subject to carbon credits by about 309 000 tonnes of CO<sub>2</sub> equivalents annually. Compared with the performance indicator of 1 million tonnes of CO<sub>2</sub> equivalents, the climate result for 2019 is considered to be positive, and in isolation, this amounts to 31 per cent of the level for the agreement period. The level for good goal achievement was raised from 750 000 tonnes to 1 million tonnes of CO<sub>2</sub> equivalents in connection with establishing the Zero-emission Fund for Commercial Transport, for which Enova received new funds.

**Figure 3.12**

Development in climate results 2017–2019



**Figure 3.12:** The figure shows expected climate results (ktonnes CO<sub>2</sub> equiv.) in projects receiving support from the Climate and Energy Fund in the 2017–2019 period. The results have been corrected for cancelled and final reported projects.

Greenhouse gas reductions totalling 142 000 tonnes of CO<sub>2</sub> equivalents come from industry, distributed across about 150 individual projects. About half of the emission reductions are from full-scale implementation of new innovative solutions. Then thematic efforts to mature technological solutions for the market contribute more than one-third of the climate result from industry. There are relatively significant variations among industry projects, and a few large projects are providing substantial contributions to raise the results.

In the transport sector, climate results are distributed across a considerably higher number of projects. Enova has supported 840 projects that are expected to reduce emissions by 127 000 tonnes of CO<sub>2</sub> equivalents.

The majority of these results comes from the maritime part of the sector, where electrification of maritime transport has been an important focus area. Here, many stakeholders have been working on adaptations to fully electric or hybrid battery operation for different types of vessels. Furthermore, both businesses, municipalities and county authorities have received support for charging infrastructure on land and at sea. As regards transport on land, the successful launch of support to procure electric delivery trucks generated a considerable volume of applications. This programme accounts for 87 per cent of projects in the sector and 20 per cent of climate results from the transport sector in 2019.

Other climate results are largely related to the conversion of fossil heating in buildings.

**Table 3.5**  
Climate results

Sector	2017	2018	2019	Total
	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.
Industry	28	39	142	209
Transport	218	165	127	511
Energy system	12	4	24	40
Non-residential buildings and property	12	9	2	23
Households and consumers	5	9	14	27
<b>Total</b>	<b>274</b>	<b>226</b>	<b>309</b>	<b>809</b>

**Table 3.5:** The table shows the climate result (CO<sub>2</sub> equiv.) from projects in plants not subject to carbon credits that were granted support in 2017–2019. The results are distributed by sector. The results have been corrected for cancelled and final reported projects.

Table 3.6 shows that results can change after contracts are signed. This can occur either as a result of the projects not being completed or that changes in preconditions occur that affect result achievement. The expected climate results were reduced over the course of the year from 873 000 to 820 000 tonnes

of CO<sub>2</sub> equivalents as a result of cancellations. The projects' estimated results are updated upon final reporting, which may lead to increases or reductions in the results. These updates have led to a modest reduction in climate results, to 809 000 tonnes of CO<sub>2</sub> equivalents.

**Table 3.6**  
Development in climate results 2017–2019

Sector	Original result	Result corrected for cancellations	Result corrected for final reported results
	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.
Industry	225	213	209
Transport	550	516	511
Energy system	42	39	39
Non-residential buildings and property	28	24	24
Households and consumers	27	27	27
<b>Total</b>	<b>873</b>	<b>820</b>	<b>809</b>

**Table 3.6:** The table shows the development in expected climate results (kilotonnes CO<sub>2</sub> equiv.) measured from the expected result at the time of approval, result corrected for cancelled projects and result corrected for final reported projects.

Enova also supports measures that contribute to security of supply and innovation in facilities that are subject to quotas, and climate results from these measures are calculated. As regards the 2019 portfolio, such measures are expected to contribute to a reduction of 212 000 tonnes of CO<sub>2</sub> equivalents annually. In the short term, reduced emissions in one location could lead to increased emissions at another location, since the

total emissions are determined within the carbon credit system. The emissions covered by a carbon credit requirement within the EU Emissions Trading System are therefore not included in Enova's climate results. Table 3.7 shows the number of projects, approved support and reduced greenhouse gas emissions at facilities not subject to carbon credits for 2019.

**Table 3.7**

Emission reductions subject to carbon credits

Subject to carbon credits (EU ETS)	Sector	No. of projects	Contractual support	Climate result
			NOK million	ktonnes CO <sub>2</sub> equiv.
Subject to emission credits		16	2 804	212
	Industry	15	475	12
	Energy system	1	2 330	200
Not subject to carbon credits		1 466	2 440	295
<b>Total</b>		<b>1 482</b>	<b>5 245</b>	<b>507</b>

**Table 3.7:** The table shows the number of projects in 2019 where Enova supported measures at facilities subject to emission credits<sup>1</sup> in accordance with the EU Emissions Trading System (EU ETS), as well as support granted and climate result (CO<sub>2</sub> equiv.). The Enova Subsidy is not included in the overview (20 789 measures totalling 13.5 ktonnes CO<sub>2</sub> equiv.).

<sup>1</sup> <http://www.norskeutslipp.no/no/Komponenter/Klimakvoter/Kvoteutslipp/?ComponentType=kvoteutslipp#>

### The Zero-Emission Fund

In the first half of 2019, the Ministry of Climate and Environment tasked Enova with administering a zero-emission fund for commercial transport funded over the Fiscal Budget. The Zero-Emission Fund aims to bolster the market for vessels and vehicles based on zero-emission technologies that have been tested and can be delivered in large volumes.

One of the focus areas is transitioning the private sector to electric delivery trucks, and a subsidy scheme with an automated application process was launched in August 2019. Table 3.8 shows the plan for how funds for the Zero-Emission Fund will be provided and allocated. Beyond the framework of the Zero-Emission Fund, Enova allocated close to NOK 250 million for energy measures in ships and ground transport in 2018.

**Table 3.8**

Awards and allocations in the Zero-Emission Fund

	2018	2019	Total
	NOK million	NOK million	NOK million
Zero-Emission Fund framework	50	534	584
<i>Allocations:</i>			
Electrification of maritime transport	-	375	375
Support for energy and climate measures in ships	50	-	50
Support for energy and climate measures in ground transport	-	26	26
Support for purchasing electric delivery trucks and chargers	-	95	95
<b>Total</b>	<b>50</b>	<b>496</b>	<b>546</b>
Unallocated funds transferred	-	39	39

**Table 3.8:** The table shows funds added in connection with establishing the Zero-Emission Fund, as well as allocation of these funds. Any unallocated funds at the end of each year are added to the framework for the Zero-Emission Fund in the following year.

## Projects related to infrastructure

Enova shall contribute to the development of fuel infrastructure for emission-free ground and maritime transport, including electric and hydrogen. We also provide support for area development for charging infrastructure for electric cars.

In 2019, we supported nine projects with a total of NOK 220 million associated with infrastructure for municipal and county authority transport services. The majority of the support amount, NOK 161 million, was spent to electrify buses, while other support went to projects related to infrastructure for ferries.

Support was also awarded to ten onshore power projects along the coast from Halden in the south-east to the Hurtiguten quay in Molde. This support totalled NOK 87 million.

We also supported 24 projects associated with charging infrastructure for electric cars last year, from Marnardal in Vest-Agder to Hammerfest in Finnmark. No projects within hydrogen infrastructure were supported in 2019.

**Table 3.9**

Fuel infrastructure for emission-free ground and maritime transport 2017–2019

Programme	2019				2017–2019			
	No. of projects	Contractual support	Energy result <sup>1</sup>	Climate result <sup>1</sup>	No. of projects	Contractual support	Energy result <sup>1</sup>	Climate result <sup>1</sup>
		NOK million	GWh	CO <sub>2</sub> equiv. (ktonnes)		NOK million	GWh	CO <sub>2</sub> equiv. (ktonnes)
Onshore power	10	87	30	8	49	353	175	46
Support for infrastructure for municipal and county authority transport services	9	220	108	29	21	542	233	62
Hydrogen infrastructure	-	-	-	-	7	55	-	-
Support for charging infrastructure for electric cars	24	7	-	-	72	20	-	-

**Table 3.9:** The table shows the number of projects that were granted support within Enova's programmes aimed at emission-free ground and maritime transport in 2017–2019. Energy and climate results are not calculated for Hydrogen infrastructure and Support for charging infrastructure for electric cars. The results have been adjusted for cancelled and final reported projects.

<sup>1</sup> For onshore power, an annual theoretical energy and climate potential is calculated based on the port's call statistics, the vessels' average capacity demand and potential connection time at port.

## Goal indicator for innovation

Enova shall promote increased innovation within energy and climate technology adapted to the adjustment to the low-emission society. Enova records **innovation results** from projects that contribute to increased innovation within energy and climate technology, and these results are measured in triggered capital in kroner. Triggered capital means the part of the project's investment costs that is triggered through Enova's support, i.e. investment costs less support from Enova and other public players.

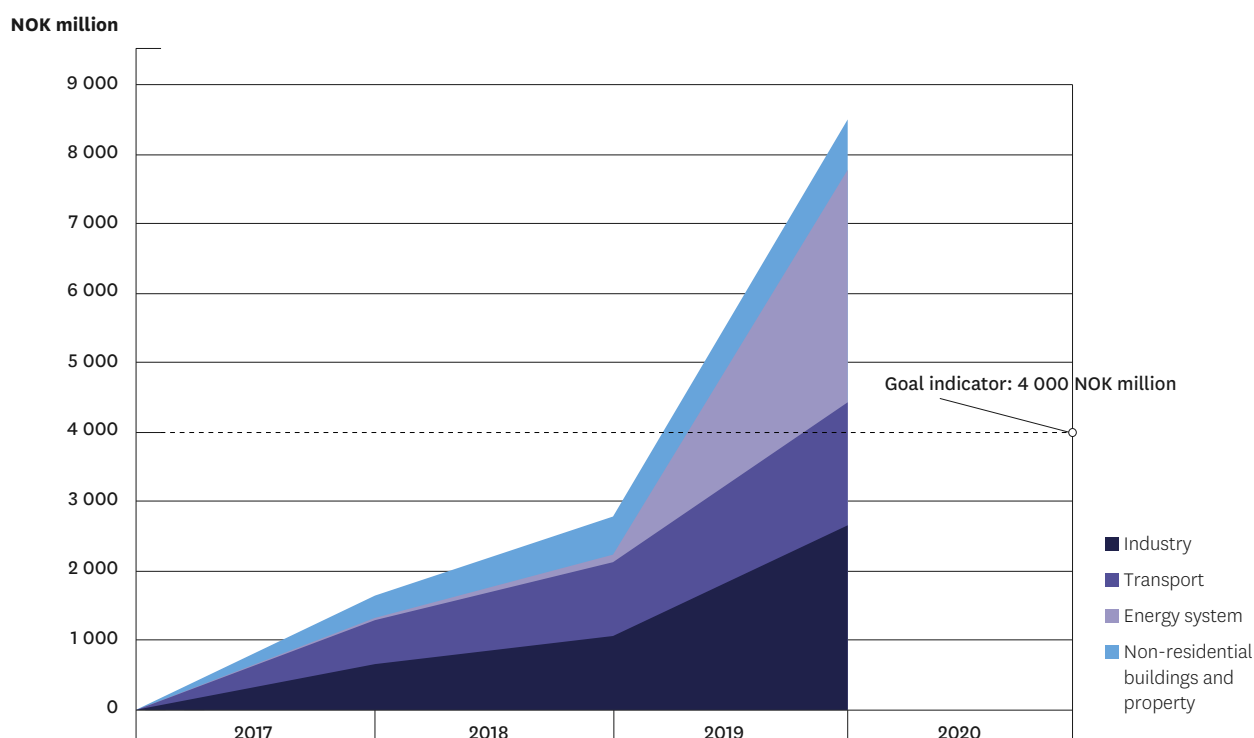
The goal of the technology projects is to harvest experience that contributes to knowledge development, innovation and dissemination of technology both nationally and internationally. Enova offers support for technology projects in all sectors. Many project owners say that it is challenging to obtain risk capital.

Enova invested a total of around NOK 3.8 billion in projects within new energy and climate technology in 2019. We have found the response to the programmes to be satisfactory and that there is a willingness to innovate and develop technology in the market. This support is expected to trigger about NOK 5.7 billion in the form of innovation capital in the market.

Compared with the goal indicator of NOK 4 billion in the agreement period, support for innovation and technology development projects was very successful in 2019. The support has triggered innovation results that exceed the indicator for good goal achievement during the agreement period.

**Figure 3.13**

Development in triggered innovation capital 2017–2019



**Figure 3.13:** The figure shows expected triggered innovation capital (NOK million) in new energy and climate technology projects that were granted support from the Climate and Energy Fund in 2017–2019. The results have been corrected for cancelled and final reported projects.

Projects within the energy system triggered the most innovation capital in 2019. These account for almost 60 per cent of the innovation result, followed by industry projects with almost 30 per cent. Transport projects constitute more than 10 per cent of the result.

Innovation results fluctuate significantly from year to year due to the impact of individual projects. Results in 2019 are almost five times higher than the previous year. This was caused by both Equinor's offshore wind project and other projects within industry and the energy system.

**Table 3.10**

Triggered innovation capital

Sector	2017	2018	2019	Total
	NOK million	NOK million	NOK million	NOK million
Industry	658	401	1 615	2 673
Transport	628	440	682	1 750
Energy system	35	59	3 271	3 364
Non-residential buildings and property	318	260	153	731
Households and consumers	-	-	-	-
<b>Total</b>	<b>1 639</b>	<b>1 159</b>	<b>5 720</b>	<b>8 518</b>

**Table 3.10:** The table shows expected triggered innovation capital (NOK million) in projects that were granted support in 2017–2019, distributed by sector. The results have been corrected for cancelled and final-reported projects as of 2019.

Table 3.11 shows that cancellations within transport have somewhat reduced the expected triggered innovation capital.

Final reporting of finished projects has had a smaller impact, in both the positive and negative direction.

**Table 3.11**

Development in triggered innovation capital 2017–2019

Sector	Original result	Result corrected for cancellations	Result corrected for final reported results
	NOK million	NOK million	NOK million
Industry	2 703	2 692	2 673
Transport	1 814	1 737	1 750
Energy system	3 366	3 362	3 364
Non-residential buildings and property	734	716	731
Households and consumers	-	-	-
<b>Total</b>	<b>8 617</b>	<b>8 507</b>	<b>8 518</b>

**Table 3.11:** The table shows the development in expected triggered innovation capital (NOK million) measured from result at time of approval, corrected for cancelled projects and corrected for cancelled and final reported projects.

Enova's technology programmes shall contribute to reducing technological risk and the technology cost of new innovative technology, so that the technology is assisted from the development stage and out into the commercial market. Technology is matured in stages through piloting, demonstration and full-scale testing. In 2019, full-scale projects within the energy system and industry triggered the greatest share of innovation capital. These are challenging projects, requiring a lot of effort on the part of the players to implement and that depend on support for realisation.

Both the number of projects receiving support and the level of support are higher than the previous year. The largest project is within the energy system, and concerns support for full-scale testing of floating offshore wind in Equinor's Hywind Tampen project (cf. Table 3.13). Support for this project constitutes more than 60 per cent of support for new energy and climate technology in 2019. The energy system also represents the largest number of technology projects, with a total of 56 projects throughout the development chain. These projects address a broad spectrum of technology solutions, such as innovative heating technology, flexible area solutions and new technology in the power grid.

38 of the projects concern support for concept studies for new construction and areas. These projects trigger a very small percentage of the private innovation capital, but are important for future potential projects. Some innovation projects are stranded at the idea stage because their associated uncertainty is too great. Through the concept assessment service, Enova enables the players to conduct more comprehensive planning before a final investment decision is made for innovative solutions.

The 34 technology projects from 29 different industry players represent a broad spectrum of industrial activity. The projects provide significant contributions to both energy, peak demand and climate results.

Within transport, there are six technology projects primarily focusing on electrification. Five of the projects are full-scale projects within maritime transport.

Projects within buildings and plants account for 27 of the 123 supported projects. One special focus area in 2019 has been to stimulate innovative solutions in the energy service market, where nine projects under this umbrella received support in 2019.

**Table 3.12**

## Support for new energy and climate technology

Sector	2019		2017–2019	
	No. of projects supported	Contractual support	No. of projects supported	Contractual support
		NOK million		NOK million
<b>Industry</b>	<b>34</b>	<b>899</b>	<b>73</b>	<b>1 423</b>
Full-scale innovative energy and climate technology	23	622	41	901
Demonstration of new energy and climate technology	2	215	5	243
Pilot testing of new energy and climate technology in industry	4	24	14	199
Pre-project support for new energy and climate technology in the industry	5	38	13	80
<b>Transport</b>	<b>6</b>	<b>186</b>	<b>25</b>	<b>611</b>
Full-scale innovative energy and climate technology	5	181	23	598
Pilot testing of new energy and climate technology in industry	1	5	2	13
<b>Energy system</b>	<b>56</b>	<b>2 622</b>	<b>63</b>	<b>2 677</b>
Full-scale innovative energy and climate technology	8	2 382	14	2 432
Large-scale demonstration and pilot project unit	8	210	8	210
Support for concept assessment in new construction and areas	38	27	38	27
Demonstration of new energy and climate technology	-	-	1	5
Pilot testing of new energy and climate technology in the energy system	2	3	2	3
<b>Non-residential buildings and property</b>	<b>27</b>	<b>69</b>	<b>163</b>	<b>445</b>
Support for energy-efficient new buildings	-	-	27	217
Introduction of new technology in buildings and areas	12	50	40	149
Support for concept assessment in new construction and areas	-	-	71	45
Commercial testing	6	12	12	24
Innovative solutions in the Energy service market for buildings	9	8	9	8
Support for new technology for the future's buildings	-	-	4	3
<b>Total</b>	<b>123</b>	<b>3 776</b>	<b>324</b>	<b>5 156</b>

**Table 3.12:** The table shows the number of projects and contractual support (NOK million) within new energy and climate technology during the 2017–2019 period, distributed by sector and programme. The figures have been corrected for cancelled and final-reported projects as of 2019. As of 2019, the programme Support for concept assessment in new construction and areas is reported under the Energy system sector (previously reported under non-residential buildings and property).

Table 3.12 shows a few examples of projects within new energy and climate technology that Enova supported in 2019.

Reference is made to Enova's website (enova.no) for more information.

**Table 3.13**

Examples of projects within nevrjy and climate technology 2019

Project owner / Project	Sector / Programme	Contractual support (NOK million)	Description / innovation
Equinor: Hywind Tampen	Energy system / Full-scale innovative energy and climate technology	2 330	<ul style="list-style-type: none"> <li>This project involves establishing a floating offshore wind farm with 11 floating wind turbines, each producing 8 MW.</li> <li>This will replace parts of existing power generation from the gas turbines on Gullfaks A and Snorre A.</li> </ul> <p>Innovation: This project involves technology development with the aim of reducing costs and improving technology for future projects. Particular focus on larger turbines, new installation methods, simplified anchoring, concrete floaters and gas power and wind power in interaction.</p>
Norsun AS: Producing larger, thinner wafers for highly efficient solar cells with high ingot utilisation	Industry / Demonstration of new energy and climate technology	195	<ul style="list-style-type: none"> <li>This project involves producing wafers with a 27% larger diameter, reduced thickness and with an ingot utilisation rate of 97%.</li> </ul> <p>Innovation: Utilising a greater proportion of the ingot (97%) for solar cells with high efficiency. Thinner and larger wafers will provide improved utilisation of ingots and entail considerably less poly consumption per wafer.</p>
Asko Norge AS: Sea drone in fully electric transport chain	Transport / Full-scale innovative energy and climate technology	119	<ul style="list-style-type: none"> <li>Establishing autonomous maritime transport of Euro trolleys between Moss and Holmestrand as part of a fully electric transport chain between ASKO's warehouses in Vestby and Sande.</li> <li>The maritime transport will take place with two autonomous ro-ro vessels (sea drones) and will entail an energy consumption reduction of 11 GWh and provide a climate result of 5.1 kilotonnes of CO<sub>2</sub>e per year compared with alternative ground transport by lorry.</li> </ul> <p>Innovation: Autonomous load handling with zero emissions. Autonomous maritime transport of trolleys on ro-ro vessels. Fully electric multi-modal transport chain. Ro-ro freight transport with zero emissions.</p>
Asker municipality: Shared heating plant – Risenga athletic park	Non-residential buildings and property / Introducing new technology in buildings and areas	12	<ul style="list-style-type: none"> <li>This project involves establishing a new, shared heating plant for seven athletic buildings and athletic facilities at Risenga in Asker municipality. The project's goal is to optimise the flow of energy between the athletic facilities in a coordinated system for load and energy management.</li> </ul> <p>Innovation: Coordinated automation and operations control system for Risenga athletic park with energy savings of up to 5 GWh. High utilisation of surplus heat from artificial ice surfaces. Demand reduction by eliminating the use of an electric boiler.</p>

**Table 3.13:** The table shows examples of projects within new energy and climate technology approved in 2019. For a more detailed overview of these projects and other climate and energy technology projects approved in 2019, please see Enova's website [www.enova.no](http://www.enova.no)

## Performance indicators for energy and demand

Enova shall promote strengthened security of supply through flexible and efficient demand and energy consumption. Enova records **energy results** for the projects it supports. Energy results measure what the projects deliver per year, either through more efficient consumption of energy, increased production and/or use of renewable energy. Energy results are measured in kilowatt-hours (kWh). Enova can also record **reduced peak demand results** for projects that result in a reduced peak demand and increased flexibility in the power system. This includes measures

that can limit winter loads and reduce short-term peaks. Reduced peak demand results are measured in kilowatts (kW).

Security of supply means that society has secure access to the energy it requires – the desired quantity at the correct time at a predictable and sustainable cost. There are many aspects to security of supply. In the long term, we want access to energy sources that ensure sustainable growth and welfare – energy security.



In the shorter term, elements related to electricity are emphasised, based on a desire for securing good delivery quality and that sufficient capacity is available. As a society, we want to avoid interruptions in the electricity supply, because this could entail major societal costs. In the low-emission society, it is presumed that oil and gas production must largely be replaced by other value creation, for example land-based power-intensive industry, to be able to maintain the prosperous welfare level in our society. A safe, efficient and renewable energy supply is crucial for achieving this.

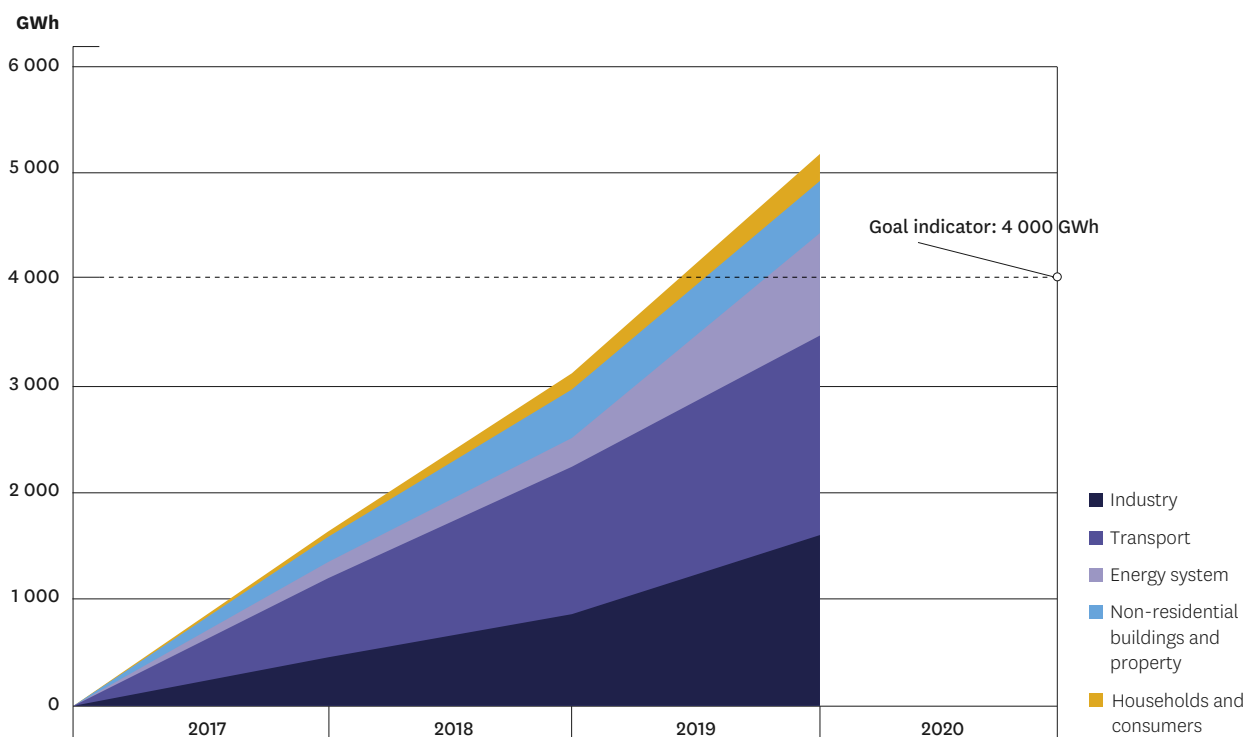
Improvement of the long-term security of supply is measured in the form of energy volume (kWh), while we measure improvement of the short-term security of supply in the form of reduced peak demand in the power grid (kW). In 2019, Enova supported projects that are expected to yield 2.1 TWh in energy results and 177 MW in reduced peak demand results.

### Energy results

The energy result of 2.1 TWh is considered good in relation to the performance indicator of 4 TWh over the course of the agreement term, and amounts to more than half of the level for the term as a whole.

**Figure 3.14**

Development in energy results 2017–2019



**Figure 3.14:** The figure shows expected energy results (GWh) in projects that received support from the Climate and Energy in the 2017–2019 period. The results have been corrected for cancelled and final reported projects.

Energy results in 2019 are fairly equally distributed between industry, the energy system and the transport sector. The largest energy results come from 155 industry projects, accounting for more than one-third of the result. In 2019, 23 full-scale projects with innovative energy and climate technology provided particularly strong contributions, both in energy results and innovation results. The process industry and food industry are well-represented, and these energy results are primarily from reduced use of energy. The energy system also contributes about a third of the energy results. Full-scale projects provide the greatest contributions here as well, but here the results are primarily from the production of renewable energy or conversion to renewable energy sources. This is in addition to heat production from a few relatively large district heating projects, and a high number of heating plants.

The transport sector contributes more than 20 per cent of the energy results, and the majority of this is caused by energy efficiency measures and conversion as a result of electrifying transport at sea and on land.

Energy results from households and consumers account for 5 per cent, and come from implemented measures that received grants through the Enova Subsidy.

Energy results within non-residential buildings and property account for 2 per cent in 2019, and the majority of the results from these 245 projects come from measures in existing buildings that save energy.

**Table 3.14**  
Energy results

Sector	2017	2018	2019	Total
	GWh	GWh	GWh	GWh
Industry	456	404	746	1 607
Transport	738	646	481	1 866
Energy system	162	117	683	962
Non-residential buildings and property	233	220	45	498
Households and consumers	52	87	110	249
<b>Total</b>	<b>1 643</b>	<b>1 474</b>	<b>2 065</b>	<b>5 182</b>

**Table 3.14:** The table shows expected energy results (GWh) in projects that received support in 2017–2019, distributed by sector. The results have been corrected for cancelled and final-reported projects as of 2019.

The expected energy results have been reduced as a result of both cancellations and final reporting. Table 3.15 shows that cancellations have generally reduced the energy results by about five per cent. In final reporting, industry projects and projects

within non-residential buildings and property have their energy results reduced by about four per cent, while other sectors have smaller changes.

**Table 3.15**  
Development in energy results 2017–2019

Sector	Original result	Result corrected for cancellations	Result corrected for final reported results
	GWh	GWh	GWh
Industry	1 737	1 657	1 607
Transport	2 032	1 887	1 866
Energy system	972	960	962
Non-residential buildings and property	554	505	498
Households and consumers	249	249	249
<b>Total</b>	<b>5 544</b>	<b>5 259</b>	<b>5 182</b>

**Table 3.15:** The table shows the development in expected energy result (GWh) measured from result at time of approval, corrected for cancelled projects and final reported projects.

The projects supported by Enova can be divided into four categories; production, energy efficiency, distribution and conversion.

Production projects include all projects where electricity or renewable heating is produced, either for sale or internal use. Establishment and expansion of district heating plants involves development of new infrastructure, and these projects are categorised as distribution projects.

Conversion projects involve changing energy carrier from electricity or fossil energy carriers to renewable energy carriers, for example based on bio-energy. A project that converts from one energy carrier to another often comprises both conversion and increased energy efficiency. One example is electrification within transport, where diesel is replaced with electricity. An

electric motor has a higher efficiency than the diesel engine. Enova therefore calculates an energy result related to the conversion from diesel, and an energy result from increased energy efficiency when an electric motor is used instead of a diesel engine.

In 2019, the largest energy results were from conversion projects, followed by energy efficiency measures. Both of these categories receive contributions from projects in all sectors, while production and distribution of energy is taking place in a more specialised manner. Table 3.16 shows how different types of energy results are distributed for each sector, while Figure 3.15 shows overall distribution of project categories for the 2017–2019 period. Energy efficiency measures have traditionally been the largest project category.

**Table 3.16**

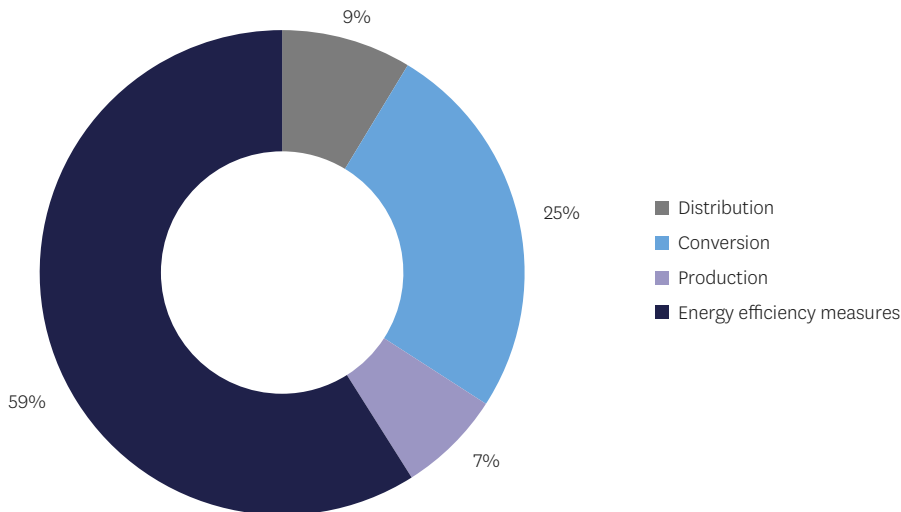
2019 energy result distributed by project category

Sector	Energy efficiency measures	Production	Distribution	Conversion
	GWh	GWh	GWh	GWh
Industry	457	71	-	217
Transport	341	-	-	140
Energy system	3	23	192	467
Non-residential buildings and property	43	1	-	1
Households and consumers	21	7	-	82
<b>Total</b>	<b>865</b>	<b>102</b>	<b>192</b>	<b>906</b>

**Table 3.16:** The table shows energy results (GWh) in 2019 distributed by project category and sector. The figures have been corrected for cancelled projects.

**Figure 3.15**

Energy results distributed by project category 2017–2019



**Figure 3.15:** The figure shows the distribution of expected energy results (GWh) in the 2017–2019 period distributed by project category.

Table 3.17 shows the energy result from production, distribution and conversion distributed by renewable energy carriers that Enova has supported. This amounts to an energy result of 1200 GWh. Electricity accounted for the largest share of energy

deliveries in 2019, with 528 GWh. The next energy carriers are bio-energy, heat pumps, waste heat and waste. The contributions from other energy carriers were modest in 2019.

**Table 3.17**

Energy result within production, distribution and conversion, distributed by energy carrier

Energy carrier	Energy result
	GWh
Electricity	528
Bioenergy	313
<i>Pellets and briquettes</i>	219
<i>Chips</i>	80
<i>Biogas</i>	10
<i>Other bio</i>	4
Heat pump	144
Waste heat	122
Waste	76
Other renewable	7
Geothermal	6
Solar	3
District heating	2
Wind	0
<b>Total</b>	<b>1 200</b>

**Table 3.17:** The figure shows the energy result within production, distribution and conversion distributed by energy carrier.

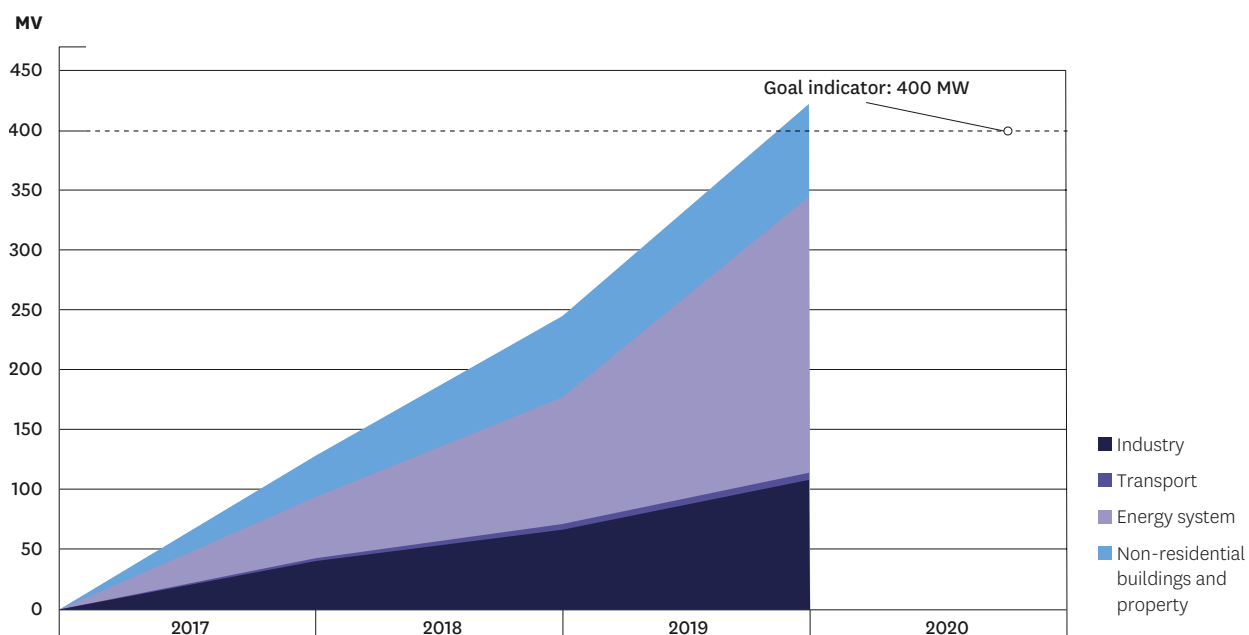
### Reduced peak demand results

The reduced peak demand result of 177 MW is considered to be good, compared with the goal indicator of 400 MW.

The result constitutes 44 per cent of the level desired for the entire agreement period.

**Figure 3.16**

Development in reduced peak demand results 2017–2019



**Figure 3.16:** The figure shows expected energy results (MW) in projects that received support from the Climate and Energy Fund in the 2017–2019 period. The results have been corrected for cancelled and final reported projects.

Table 3.18 shows that the energy system contributed the greatest reduced peak demand results in 2019, followed by non-residential buildings and property and industry.

Out of a total of 358 projects providing reduced peak demand results, 18 district heating projects account for half the total reduced peak demand result. The greatest strain on the power grid is normally on a cold winter day, and then district heating provides a strong contribution toward reducing this strain.

In 2019, full-scale projects within the energy system and industry also provide significant reduced peak demand results. Industry projects most frequently contribute by conversion or energy efficiency measures reducing peak demand in the power grid, while innovative energy system projects often test load balancing technology and battery storage.

Table 3.19 shows that the reduced peak demand results are relatively stable, with minor adjustments for cancellations and final reporting.

**Table 3.18**  
Reduced peak demand results

Sector	2017	2018	2019	Total
	MW	MW	MW	MW
Industry	41	25	43	108
Transport	2	3	-	6
Energy system	51	55	126	231
Non-residential buildings and property	34	34	9	77
Households and consumers	-	-	-	-
<b>Total</b>	<b>128</b>	<b>117</b>	<b>177</b>	<b>422</b>

**Table 3.18:** The table shows expected reduced peak demand results (MW) for projects that received support in the 2017–2019 period, distributed by sector.

**Table 3.19**  
Development in reduced peak demand results 2017–2019

Sector	Original result	Result corrected for cancellations	Result corrected for final reported results
	GWh	GWh	GWh
Industry	116	114	108
Transport	11	10	6
Energy system	230	227	231
Non-residential buildings and property	84	80	77
Households and consumers	-	-	-
<b>Total</b>	<b>441</b>	<b>430</b>	<b>422</b>

**Table 3.19:** The table shows the development in expected climate results (MW) measured from result at the time of approval, result corrected for cancelled projects and result corrected for final reported projects.

## Energy results and allocations 2012–2016

Table 3.20 shows the allocation of funds from the Climate and Energy Fund and total energy results from the period 2012–2016, updated at the end of 2019, distributed by markets and year. These projects were assigned during the previous agreement term. In the event that projects are cancelled, the energy result is corrected for the year the contract was originally signed and recorded. The contractual support amount is released and returned to the Climate and Energy Fund for investment in new projects. NOK 154 million was released in

2019 from cancelled and final reported projects. These projects entail that the expected energy result for the 2012–2016 period has been reduced by 131 GWh since the status reporting at year-end 2018.

Enova granted just under NOK 10 billion in support for energy projects during the 2012–2016 period. The total investments that this support shall trigger amount to about NOK 25 billion. The size of Enova's subsidy varies from market to market.

**Table 3.20**

The Climate and Energy Fund's energy results and allocations 2012–2016

	2012		2013		2014		2015		2016		Total	
	GWh	NOK million	GWh	NOK million	GWh	NOK million	GWh	NOK million	GWh	NOK million	GWh	NOK million
Renewable heating	222	223	343	377	321	333	155	208	164	202	1 204	1 343
Renewable power	3	5	6	13	0 5	1	3	19	7	12	19	50
Industry	554	484	399	263	1 025	2 063	569	829	2 578	606	5 126	4 245
Transport	-	-	-	-	-	-	165	248	642	797	808	1 045
Non-industrial plants and facilities	5	3	12	34	31	30	63	66	22	20	133	154
Non-residential buildings	402	438	357	541	268	344	304	405	291	421	1 622	2 149
Residential buildings	24	77	26	104	18	51	90	136	41	119	200	488
International projects	-	3	-	6	-	2	-	3	-	3	-	17
Consultation and communication	-	56	-	65	-	55	-	53	-	61	-	289
External analyses and development measures	-	32	-	27	-	32	-	23	-	36	-	149
Administration	-	98	-	110	-	129	-	148	-	151	-	635
<b>Total</b>	<b>1 210</b>	<b>1 419</b>	<b>1 143</b>	<b>1 540</b>	<b>1 664</b>	<b>3 039</b>	<b>1 349</b>	<b>2 138</b>	<b>3 746</b>	<b>2 428</b>	<b>9 113</b>	<b>10 564</b>
<b>Of which:</b>												
Ordinary energy projects	1 203	1 184	1 089	1 189	1 528	1 129	1 076	955	3 538	1 684	8 434	6 142
Projects within new technology	7	45	54	142	136	1 694	273	957	208	494	679	3 332

**Table 3.20:** The table shows aggregated energy results and funds allocated from the Climate and Energy Fund during the period 2012–2016, corrected for cancelled and final-reported projects as of 2019. Projects within the programmes for new energy and climate technology are distributed in the respective markets. As of 2015, the Support for biogas and biofuel programme is reported under the Transport market.

Table 3.21 shows the contractual energy result for the 2012–2016 period distributed by market and year, before and after correction for cancelled, final-reported and realised results. Projects corresponding to about 14 per cent of the original contractual result were cancelled. We see that the contractual

energy result is generally changed marginally in connection with correction for final-reported and realised results. The exception is for industry, where the energy results are improved upon final reporting and subsequent measurement of realised results.

**Table 3.21**

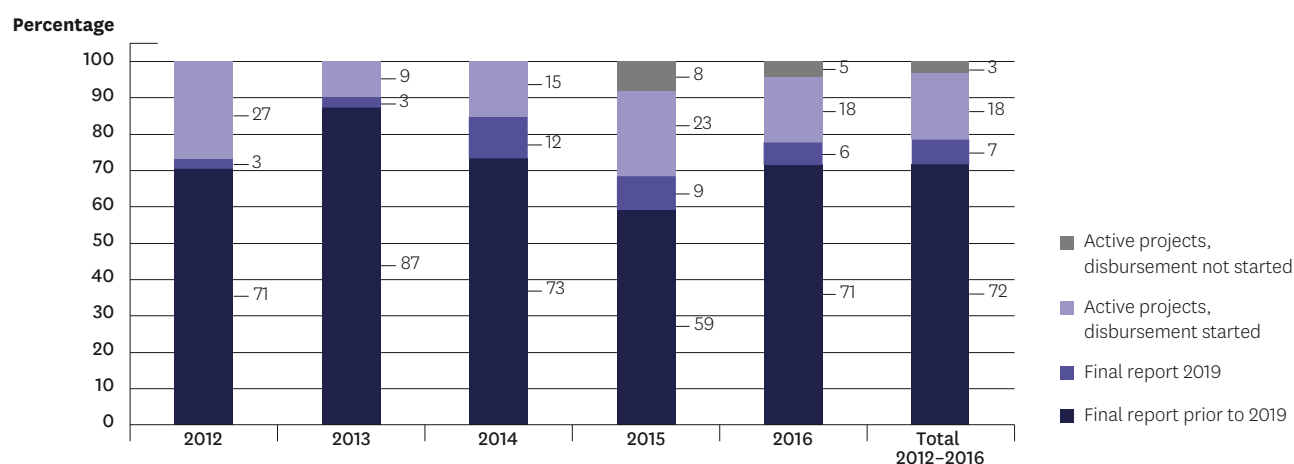
Energy results 2012–2016 distributed by markets

Market	Gross contractual result	Contractual result	Contractual corrected for final reported result	Contractual corrected for final reported and realised result
	GWh	GWh	GWh	GWh
Renewable heating	1 454	1 191	1 204	1 208
Renewable power	56	20	19	19
Industry	5 231	4 779	5 126	5 105
Transport	971	821	808	808
Non-industrial plants and facilities	159	135	133	132
Non-residential buildings	2 148	1 777	1 622	1 608
Residential buildings	345	206	200	201
<b>Total</b>	<b>10 363</b>	<b>8 927</b>	<b>9 113</b>	<b>9 081</b>

**Table 3.21:** The table shows the contractual energy result (in GWh) distributed by markets, both before and after correction for cancelled, final-reported and realised projects. The "Contractual result" column shows the energy result at the end of 2019 corrected for cancellations.

**Figure 3.17**

Percentage of final-reported projects approved during the 2012–2016 period



**Figure 3.17:** The figure shows the percentage of final-reported and active projects at the end of 2019, distributed by approval year and overall for the period. The figure also shows the percentage of projects where disbursement has started. The percentages are calculated according to the projects' energy results.

Figure 3.17 shows the percentage of final-reported projects for 2012–2016, measured according to the projects' energy results. We can see that more than 70 per cent of the energy result from the period was finally reported as of the end of 2019. The ratio of final-reported projects generally increases with age; this is shown for the 2013–2016 period. As regards the 2012 projects, close to 99 per cent of the projects have submitted final reports, but the last percentage point accounts for 27 per cent of the results.

The figure also differentiates between active projects where disbursement has started and active projects where disbursement has not started. The risk of a project being cancelled has turned out to be significantly lower when disbursement of support has started. Only 3 per cent of the result is associated with projects

where disbursement has yet to start. This is a 50% reduction compared with the status at the end of 2018. As regards the 2015 cohort, the ratio dropped from 21 per cent to 8 per cent at the end of 2019. Measured in number of projects, disbursement has yet to start for less than 2 per cent of the projects for the entire period. Enova actively follows up the projects' progress and completion. Systematic and good follow-up will contribute to ensuring the projects are carried out in line with the agreements. In those cases where projects will not be implemented for various reasons, close monitoring ensures that the funds will not be unnecessarily stuck in projects with no progress.

In 2019, about 600 TWh has been finally reported from projects that were approved in 2012–2016.

## Stories – Enova's impact

The following pages will present a few stories as examples of Enova's impact.

### District heating has been established as infrastructure and is still growing and developing



District heating is a parallel infrastructure to the power system that makes it possible to use, produce, distribute, store and recycle thermal energy from a number of sources in an efficient manner. An increase in power consumption of between 30–50 TWh<sup>3</sup>, is expected in the period leading up to 2040, primarily within transport and industry. District heating can cover up to 40 per cent of heating needs on the coldest days of the year when demand peaks, and represents a good alternative to fully electric heating. In other words, this power can be used to cover an increasing need for power in other sectors.

District heating can utilise a number of different energy sources, such as waste heat from power-intensive industry, waste incineration, bio-energy or electricity in the form of heat pumps, electric boilers and solar energy.

Just as for other infrastructure, district heating is characterised by high establishment costs, but also low marginal costs, where the benefit is only achieved when a large number of customers are connected and can share the fixed costs. However, it is challenging to get a development started if the entire establishment cost and risk associated with further development falls on the district heating company alone. Enova has therefore supported the establishment of district heating and development of district heating infrastructure since its inception in 2001, and has contributed to the establishment of district heating in more than 130 cities and towns. Many of these have further expanded

their service. 92 per cent of all Norwegian cities with more than 10 000 inhabitants now have district heating or are in the process of implementing it<sup>4</sup>.

#### Development in production, infrastructure and customers

The use of district heating has doubled since 2007<sup>5</sup> and the development pace has been high. The total length of the infrastructure in 2018 was about 1 900 kilometres<sup>6</sup>, equivalent to the distance from Oslo to Alta along E6. In new projects, we are increasingly seeing investments being carried out without state support. Compaction is currently expected to take place on commercial terms, and Enova no longer sees a need to support expansions of the existing distribution grid. Enova will still support projects such as district heating companies converting from fossil to renewable heating (peak load), establishing new plants in new areas and transfers between an established district heating grid to a new one.

Since 2002, Enova has contributed NOK 3.73 billion to 566 district heating projects, and total investments amount to NOK 18.11 billion and 5.4 TWh. The support ratio from Enova varies based on the projects' profitability and risk.

Profitability in the industry has increased in recent years as a result of increasing numbers of customers connecting to the infrastructure and a higher price of energy<sup>7</sup>.

<sup>3</sup> Statnett (2019) *Et elektrisk Norge – fra fossilt til strøm (An electric Norway – from fossil fuel to electricity)*

<sup>4</sup> Norsk Fjernvarme (2017) <https://www.fjernvarme.no/fakta/fjernvarme>

<sup>5</sup> <https://www.ssb.no/energi-og-industri/statistikker/fjernvarme>

<sup>6</sup> <https://www.ssb.no/energi-og-industri/artikler-og-publikasjoner/okt-forbruk-av-fjernvarme>

<sup>7</sup> <https://www.ssb.no/energi-og-industri/statistikker/fjernvarme>



**Figure 3.18**

Price of district heating and sales revenues Norwegian district heating companies



**Figure 3.18:** The figure shows the development in the price of district heating (average price excl. VAT) and sales revenues in Norwegian district heating companies in 2002–2018.

**Source:** Statistics Norway

**Figure 3.19**

Enova's support to district heating projects and price of district heating



**Figure 3.19:** The figure shows Enova's support for district heating projects (allocation year) and development in price of district heating (average price excl. VAT) in 2002–2018.

**Source:** Statistics Norway

## High-temperature heat pumps have been developed and introduced on the market



The less energy-intensive part of mainland industry has an annual energy consumption of just under 14 TWh, corresponding to about 18 per cent of mainland industry's total energy consumption. Using oil and gas for heating purposes is the primary source of greenhouse gas emissions.

The food industry and other industries that need steam or hot water and have high demands for load regulation have traditionally used oil and gas as well as some electricity for process heat. The use of oil and gas for heating purposes has been relatively stable over the last fifteen years at around 4 TWh, and the renewables ratio has only increased marginally. Rather than choosing other renewable alternatives, the trend has been to transition from oil to gas. In 2003, oil accounted for more than 80 per cent of fossil energy consumption, and gas about 20 per cent. In 2018, oil accounted for 38 per cent, while gas has emerged as the preferred alternative. This is the landscape where high-temperature heat pumps have found their place as an important part of the solution.

Heat pumps have long been unsuitable for this type of heat generation due to the lack of a suitable cooling medium and unsatisfactory efficiency at high temperatures and temperature

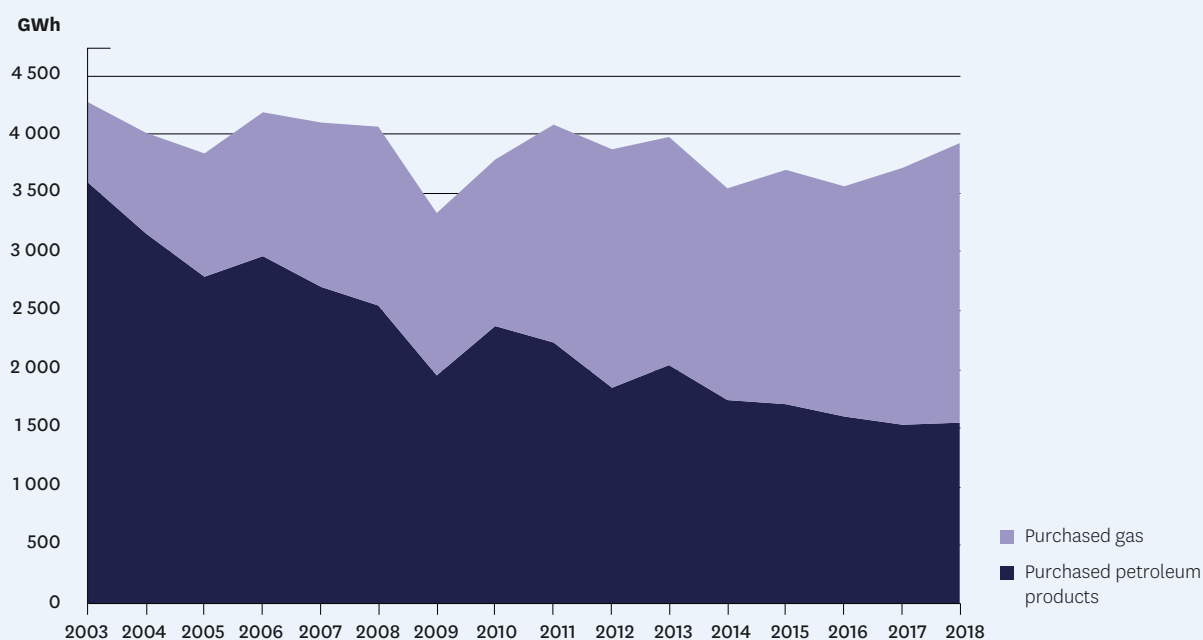
lifts. This is about to change, as technology development over time has made heat pump systems that can handle increasingly higher temperatures and temperature lifts possible.

While oil, gas and electricity are characterised by relatively low investment costs and high operating costs, the situation is reversed for heat pumps. A commercial breakthrough for high-temperature heat pumps therefore requires lower investment costs and higher efficiency.

High-temperature heat pumps have e.g. been utilised in Norwegian dairies and other food industry. Enova has supported a number of heat recovery projects in dairies at different temperature levels. We're seeing a clear decline in costs for these projects. We expect this development to continue with increasing commercial access to technologies.

Enova considers this to be an important solution on the road to a low-emission society, but it is still challenging to achieve profitability in projects and a sufficient volume to ensure that the technology can stand on its own in competition with familiar solutions. This solution has now been demonstrated and additional competing suppliers and solutions will help reduce prices.

**Figure 3.20**  
Fossil energy sources over time



**Figure 3.20:** The figure shows the distribution between fossil energy sources used for heating purposes in the industry in 2003–2018 measured in GWh. Source: Statistics Norway

# Heat pumps in single-family houses and small homes have become a technologically and commercially mature technology



Small homes and single family houses make up a considerable share of Norwegian buildings, with about 56 per cent of the total building area, and heating is the largest energy expense for the vast majority. While heating needs in Norway are not vastly different from other countries with cold climates, we are special in the sense that we use a lot of electricity for heating. Heating needs have therefore for long periods been a design factor for developing the Norwegian power supply, and it has been a goal to reduce the ratio of electricity used for direct heating.

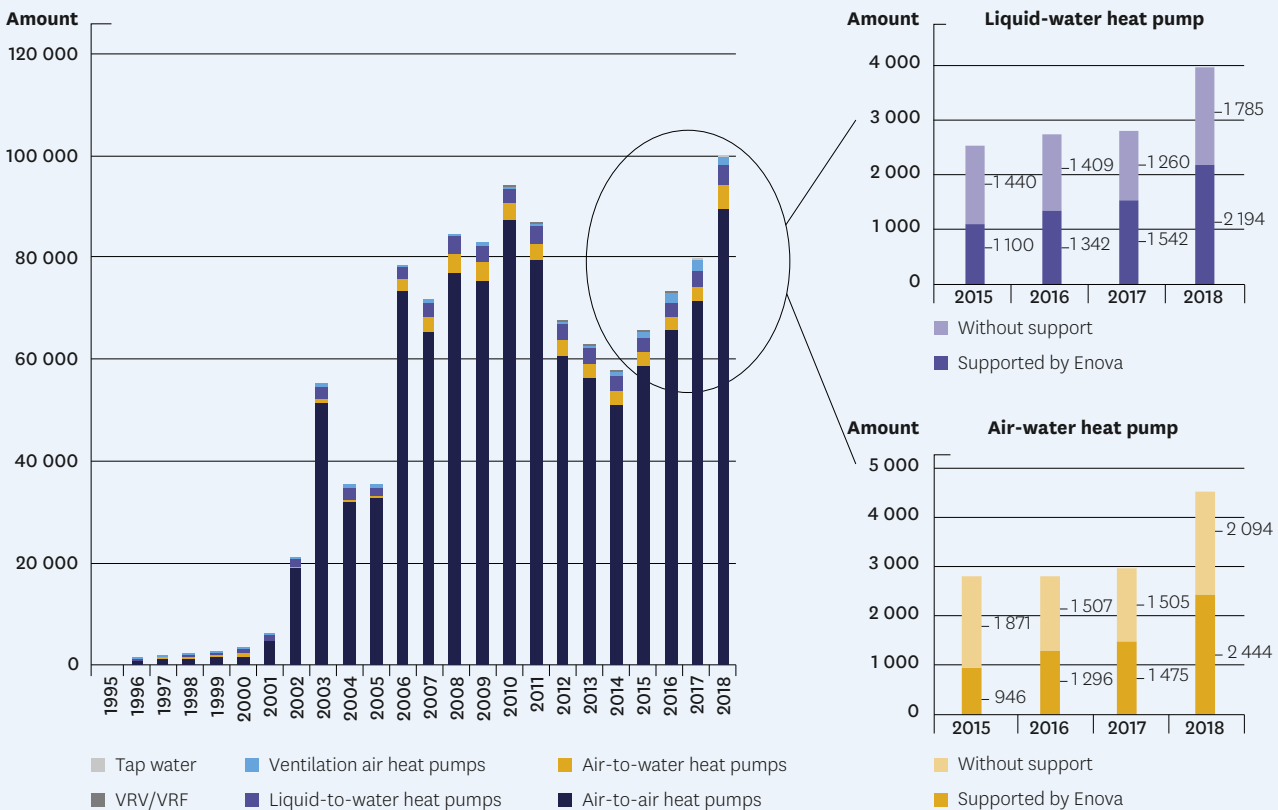
Heat pumps are an energy-efficient heating technology which experienced a breakthrough in the Norwegian market in the early 2000s with the introduction of air-to-air heat pumps, another area where Enova contributed. About 1.1 million air-to-air heat pumps have been sold since 2003 without any form of support.

Topics such as reduced use of electricity for heating and reduced peak demand are again becoming increasingly relevant and are

gaining renewed attention as more and more parts of society are electrified. This also comes with a need to develop and introduce heat pumps that can be part of flexible heating systems and cover an increasingly larger share of heating needs. This means air-to-water heat pumps and liquid-to-water heat pumps that can supply heat to waterborne and, in some cases, airborne distribution systems.

After supporting the introduction of air-to-water heat pumps for several years, the technology is now considered to be mature and established in the market. Enova is therefore in the process of ending its support for introducing such heat pumps on the market. Liquid-to-water heat pumps are also becoming a mature technology, but are also dependent on stakeholders with expertise in drilling energy wells establishing themselves across the country. This is especially desirable in order to achieve a certain element of competition in the market. As we await further market developments, Enova will continue to contribute to the introduction of liquid-to-water heat pumps.

**Figure 3.21**  
Overall market for heat pumps 1995–2018



**Figure 3.21:** The figure shows the number of heat pumps sold in 1995–2018 distributed by type of heat pump. The excerpt shows sales in the number of air-water and liquid-water heat pumps in 2015–2018 distributed by the number of measures that received support from Enova and the number of measures without support from Enova.

**Source:** Norsk Varmepumpeforening [Norwegian heat pump association] (NOVAP) and Enova

## Passive houses have established themselves as a new construction standard and energy-efficient buildings are market-leading on the property market



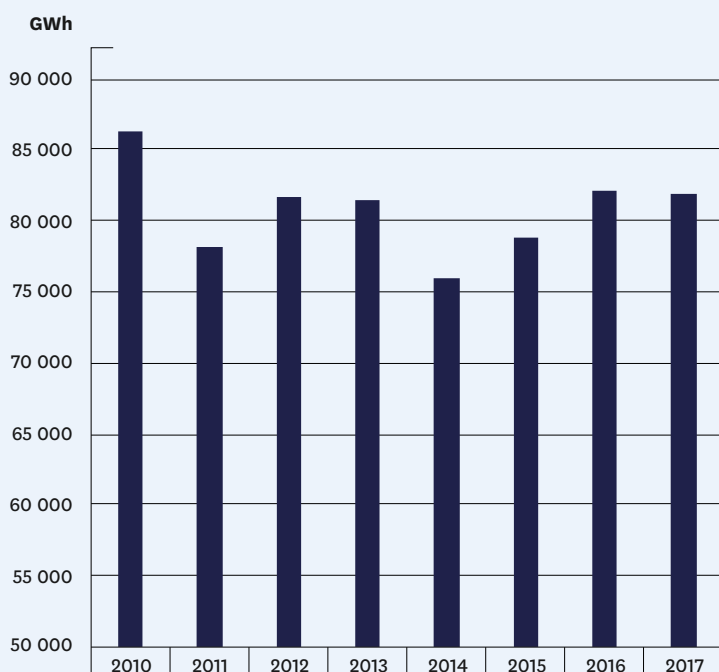
Out of consideration for both general resource efficiency and strain on the energy system, it has been a goal to introduce passive houses as a new construction standard and energy-efficient buildings as market leaders in the construction and property market.

Through a goal-oriented focus on passive houses in 2010–2013, Enova invested close to NOK 1 billion in a total of 567 construction projects, and passive houses have gone from a "well-kept secret" in the construction market to a generally accepted standard. In the wake of Enova helping toward the demonstration and introduction of passive houses in Norway, the passive

house level found its way into the Regulations on technical requirements for construction works (TEK), and the minimum requirement in the current regulation (TEK 17) is approaching passive house-level. Among other things, this entails that the requirement for energy consumption in a new single family house is currently about 55 per cent lower than the average energy consumption in existing single family houses. The innovative projects Enova has supported will contribute to a 10–90 per cent reduction in energy and peak demand beyond the requirements in the Regulations on technical requirements for construction works.

**Figure 3.22**

Energy balance in service sector and households



**Figure 3.22:** The figure shows the energy balance (GWh) in the service sector and households in 2010–2017.

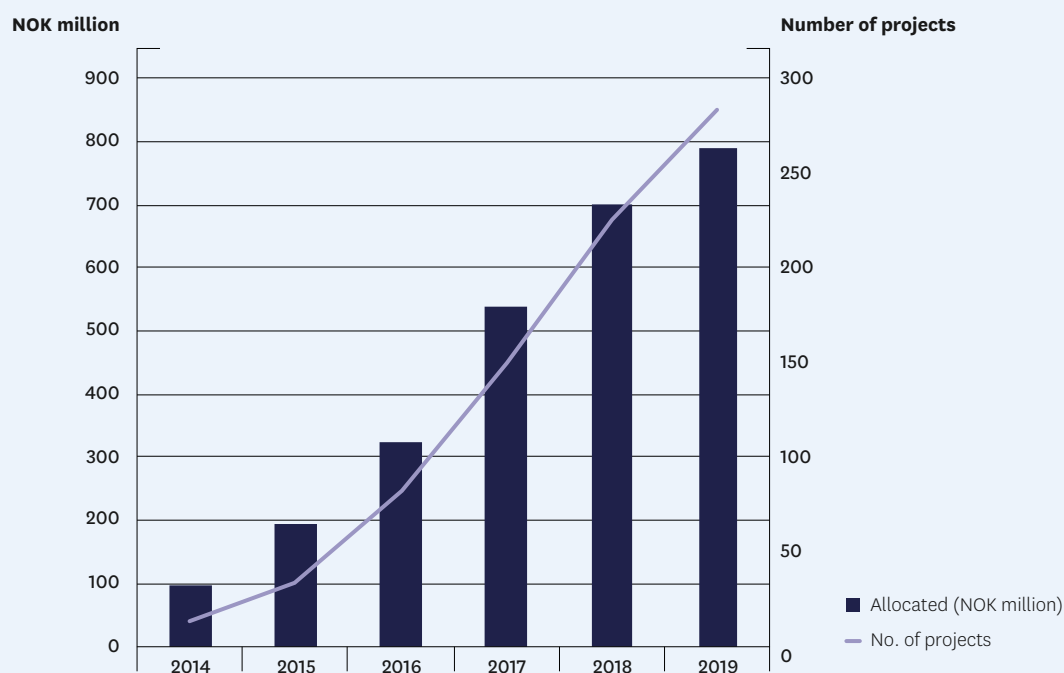
**Source:** Statistics Norway

In order to maintain this development in a market substantially based on minimum requirements and standardised solutions, it is desirable for energy efficiency to be valued by those who constitute the frontline of the construction and property market, meaning the players building new construction and which are otherwise concerned with providing buildings of high quality. Enova therefore prioritises supporting innovative construction

players that utilise new energy technology which contributes toward reducing energy needs and, to an increasing extent, peak demand. By compensating for part of the risk and additional costs these players incur, Enova helps drive innovation and the cutting edge of the market. The extent to which this is happening can e.g. be seen in the number of construction players applying to Enova for technology support and what this support is intended for.

**Figure 3.23**

Enova's support for innovative construction projects (cumulative)

**Figure 3.23:** The figure shows Enova's cumulative support (NOK million) for innovative construction projects in 2014–2019.

## Market-driven development of fast chargers for electric cars



The transition to electric vehicles will help reduce emissions in large parts of the transport sector. This represents a considerable technological shift, meaning that new value chains must be developed for necessary products and services. Critical components in this electrification include access to batteries and charging infrastructure.

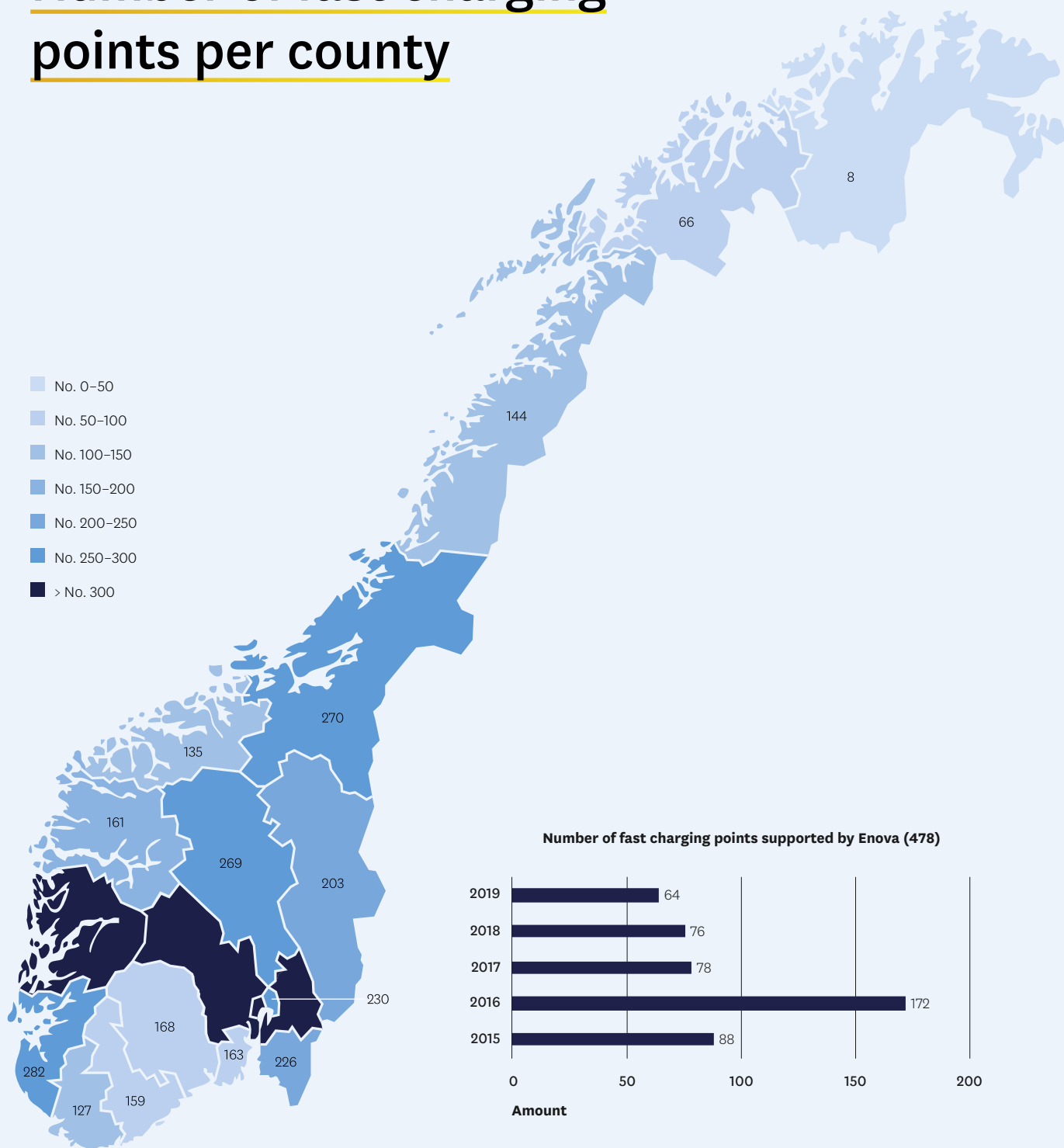
Electrification of personal vehicles is well under way in Norway. Seven per cent of Norwegian-registered passenger cars were fully electric at the end of 2018<sup>8</sup>. In 2019, zero-emission vehicles achieved a market share of new vehicle sales of 42.4 per cent<sup>9</sup>, an increase of more than 10 per cent from the previous year.

Enova's contribution toward electrifying personal vehicles has been to support a comprehensive and otherwise market-driven development of infrastructure for fast charging. So far, Enova has contributed to the establishment of a first-generation infrastructure for fast charging along national transport corridors. We are also in the process of contributing to the establishment of fast charging in regions where the traffic basis and percentage of electric vehicles are too low to justify development on commercial terms. Overall, Enova has granted support to 478 fast charging points since 2015. The rest of the market appears to be growing and developing in a positive direction, driven by increased demand and commercial considerations. The number of fast charging points in Norway has increased from about 700 in 2015 to just under 3 900 in 2019.

<sup>8</sup> Statistics Norway (2019): Bilparken (Norwegian vehicles). <https://www.ssb.no/bilreg>

<sup>9</sup> OFV (2020): Bilsalget i 2019 (Vehicle sales in 2019). <https://ofv.no/bilsalget/bilsalget-i-2019>

# Number of fast charging points per county



**Figure 3.24:** The map shows an overview of fast charging points built per county (Chademo and CCS points, and Tesla points exceeding 135 W) as of 31 December 2019, as well as the number of fast charging points supported by Enova in 2015–2019.  
**Source:** Nobil (charging point database) and Enova

## Ship electrification – the technology has been introduced and is experiencing further development and growth



Norway has a large maritime industry with stakeholders throughout the value chain from technology development and ship design to shipowners and stakeholders requesting various forms of maritime freight and maritime operations. This provides a good starting point for electrifying Norwegian shipping and developing a value chain to support such a technological shift.

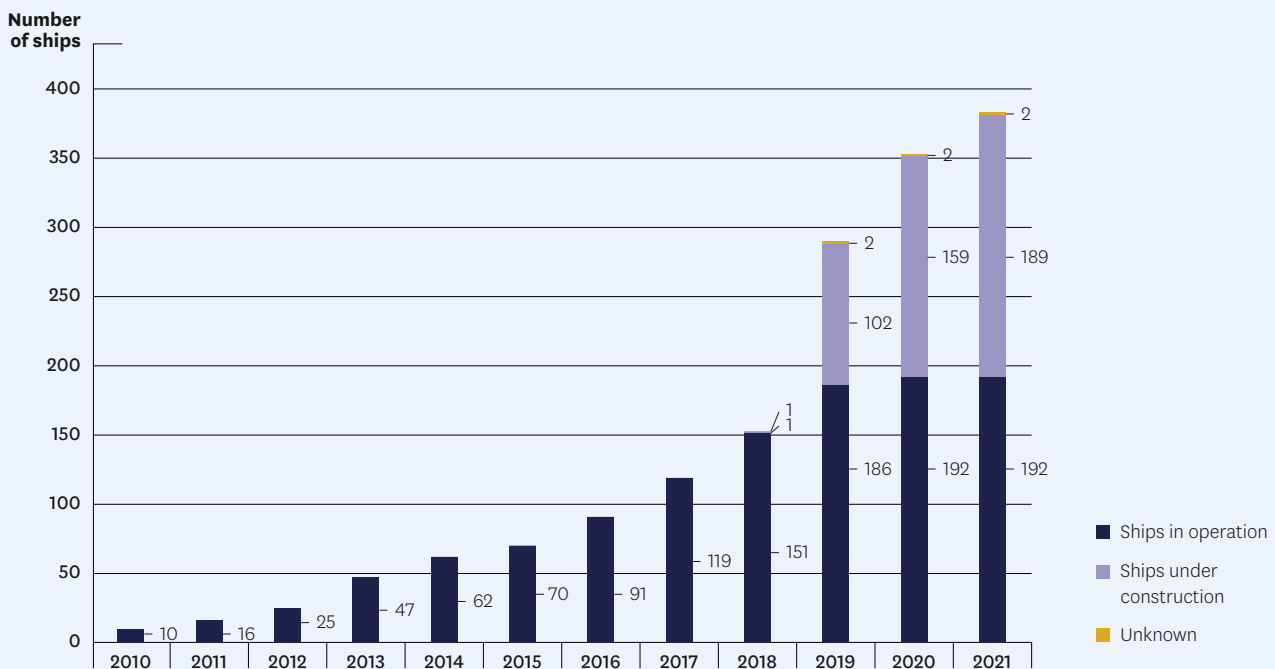
Support is currently needed for both technology development and market introduction. However, this development shows that parts of the market have undergone a considerable market maturation and that solutions are constantly being developed and demonstrated in new segments. Batteries for propulsion are now emerging as an option for all vessel segments. On a global scale, about 185 vessels with batteries are in operation – more than half of which are operating in Norway<sup>19</sup>. So far, Enova has supported battery installation and other energy efficiency measures in about 75 vessels with more than NOK 500 million, in addition to a small number of fully-electric vessels. At the same time, we have organised seven tender competitions between 2015 and 2019 to support 89 onshore power projects in more than 60 Norwegian ports with more than NOK 600 million.

Oil service is one of the markets that have shown an interest in electrification, primarily for hybridisation where batteries are combined with existing diesel-electric propulsion systems. Profitability can vary considerably from ship to ship, and hybridisation being profitable on its own is still a ways off. Nevertheless, this is a measure that an increasing number of players are deciding to implement, driven by e.g. a desire to stay competitive and positioning for future contracts where emission requirements could be set.

The ferry segment has made the most progress as regards electrification. Enova has contributed to the development of infrastructure enabling county authorities to demand low and zero-emission ferry services. In turn, this has led to the present development of the construction and use of ferries with a high ratio of battery-electric propulsion. Overall, Enova has awarded more than NOK 900 million in funding commitments for electrification of 39 ferry connections with 52 associated ferries. Despite electric ferry operation not emerging as profitable today, it is in the process of establishing itself as a standard in the market, and in 2022 there will be about 80 Norwegian battery-hybrid ferries.

**Figure 3.25**

Battery installations on ships in operation and under construction



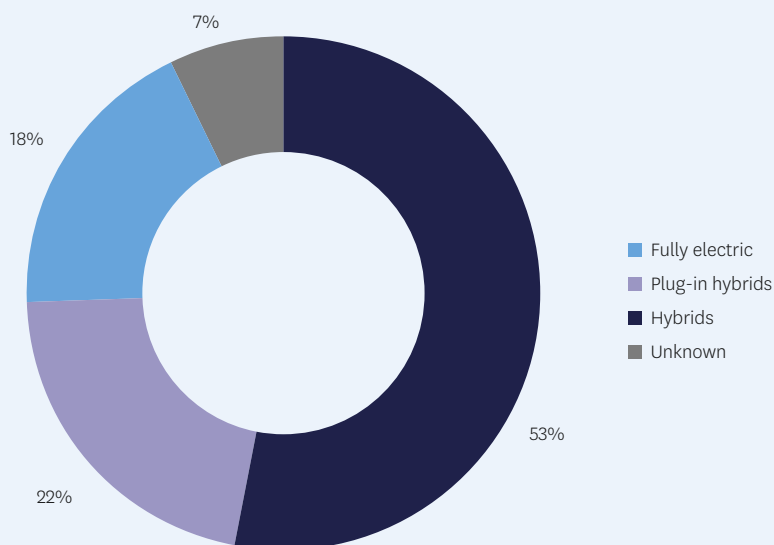
**Figure 3.25:** The figure shows the development in ships with battery installations distributed by ships in operation and ships under construction.

**Source:** DNV GL, Alternative Fuels Insight

<sup>19</sup> DNV GL: Alternative Fuels Insight

**Figure 3.26**

Type of battery installation



**Figure 3.26:** The figure shows the distribution of types of battery installations in ships.

**Source:** DNV GL, *Alternative Fuels Insight*

Interest from new segments such as fisheries, aquaculture and transport vessels shows that electrification – preferably hybridisation – is recognised as a suitable technology and preferred solution among increasing numbers of others. We have also achieved demonstration of fully-electric vessels in some segments, which shows that zero emissions is also within our grasp.

The interest and activity Enova is seeing in the market yields increased demand and latitude for additional stakeholders on the supply side. This helps establish the value chain needed to

make electrification a sustainable solution both financially and commercially. Norway has a substantial supplier and shipyard industry that both manufactures and assembles the equipment needed for electrification, and several battery manufacturers have established local activities in Norway. Environmental technology is already an important source of revenue for the supplier market, and is expected to become increasingly important moving forward<sup>11</sup>. Sales of emission-reducing technologies in the maritime industry in 2018 amounted to about NOK 28 billion, and both revenues and investments have multiplied in recent years<sup>12</sup>.

## Energy management has been introduced and established in the Norwegian industry



Industry is a major consumer of energy and a significant source of greenhouse gas emissions. As diversity changes and productivity increases, Norwegian industry has become significantly more energy-efficient and climate-friendly over the last few decades. Energy intensity in Norwegian mainland industry was reduced by 34 per cent from 1990 to 2018<sup>13</sup> but increased by 33 per cent

in mining and oil production – while emission intensity was reduced in all categories; in many cases, it was cut in half<sup>14</sup>. Studies commissioned by Enova show that a total of about 27 megatonnes of CO<sub>2</sub> equivalents can be cut from industry's total emissions using available and profitable technology, while 40 per cent is contingent on new technology

<sup>11</sup> Federation of Norwegian Industries (2019): *Norwegian Maritime equipment suppliers*.

<sup>12</sup> Menon (2019): *Grønn maritim. Status for omsetning, eksport, sysselsetting og investeringer (Green maritime. Status of sales, exports, employment and investments)*. The figure includes technologies that completely, significantly or somewhat reduce emissions of greenhouse gases and/or environmentally harmful gases. The figure does not include all changes made by shipowners as regards optimisation operations and hull changes, but does include LNG and scrubbers.

<sup>13</sup> Statistics Norway (2019): *Produksjon og forbruk av energi, energiregnskap (Generation and consumption of energy, energy accounts)*. <https://www.ssb.no/energi-og-industri/statistikker/energiregnskap>

<sup>14</sup> Statistics Norway (2019): *Utslippsintensitet for klimagasser (Greenhouse gas emission intensity)*. <https://www.ssb.no/statbank/table/09288/>

For example, the emission intensity within crude oil and natural gas extraction has been reduced by 8 per cent, within metal production 73 per cent and within aquaculture 96 per cent.



development. The rest of the emissions can be cut with solutions that are mature and available today, but which might not be considered profitable by the individual company.

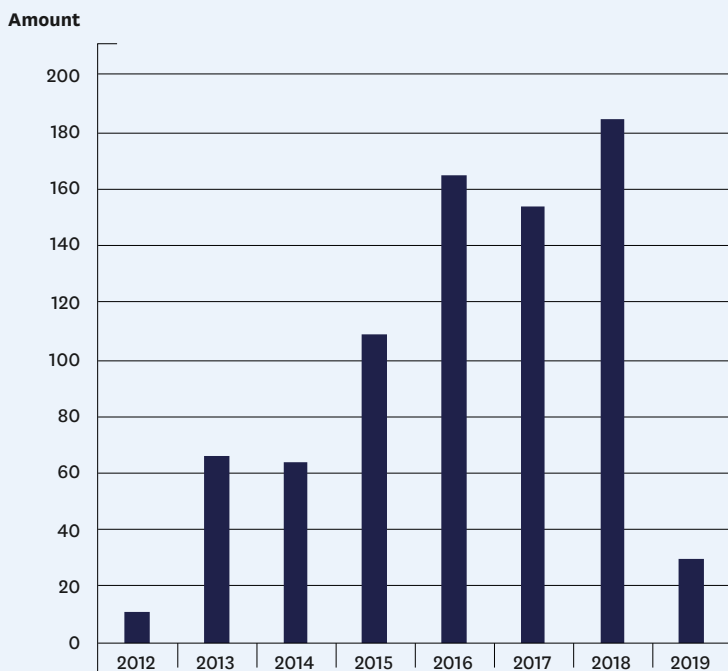
Experience shows that energy consumption can be reduced by a projected ten per cent by introducing energy management; in other words, through systematic follow-up and by taking energy consumption into consideration in day-to-day operations and light maintenance. If energy should become a consideration in new and reinvestments, the potential could increase considerably. Energy management will have the same effect on greenhouse gas emissions as energy consumption in a fossil energy context. Such a systematic approach could also contribute toward reducing emissions from other sources, but would then depend on the type of emission and industrial process. One recent example may be operations-dependent greenhouse gas emissions from aluminium plants.

Since 2012, Enova has contributed to the establishment of energy management in more than 700 Norwegian businesses and stimulated the emergence of players that can deliver necessary systems and services. There is also a cautious development in the number of Norwegian enterprises with ISO certification in energy management, but this in an area where Norway is still far behind countries like Sweden and Denmark<sup>15</sup>.

Energy management is generally a profitable measure, but a certain amount of attention, expertise and capacity is needed to get results. The elimination of Enova's support for introducing energy management at the end of 2018 showed that energy management has become a familiar measure and something many players want to implement. Energy management has been implemented in both large and small businesses, with a result of 3.7 TWh, where the greatest gains come from projects within the oil and gas sector.

**Figure 3.27**

Energy management projects supported by Enova



**Figure 3.27:** The figure shows the number of projects granted support through Enova's programme Introduction of Energy management in 2012–2019. The figures have been corrected for cancelled projects

<sup>15</sup> SO (2019): ISO Survey 2018.



# PART IV

# MANAGEMENT AND CONTROL IN THE ORGANISATION

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# Management and control in the organisation

Enova manages the Norwegian state's resources on behalf of our society. Enova's tasks must be performed in an orderly and professional manner, and the management of the Climate and Energy Fund must take place in accordance with objective and transparent criteria.

## State aid

In the majority of instances, Enova's policy instruments will fall under the EEA Agreement's definition of state aid. This means that Enova must have a legal basis in state aid law for its programmes in order to be lawful. By definition, state aid distorts competition and is therefore in violation of the EEA Agreement. The basic principle is that state aid can nevertheless be used as a policy instrument if the good cause of the support outweighs the negative effect on competition. In order to achieve a shared objective for effective energy consumption, reduced greenhouse gas emissions and security of supply, one may provide incentives to the market which lead to climate-friendly technology being chosen in lieu of less environmentally friendly alternatives.

The assumption that state aid must be lawful and appropriate, is that the support is decisive for the environmentally friendly investment being carried out. In other words, the support must only be awarded to projects that otherwise would not be carried out. The support must also be linked to the added costs associated with the environmentally friendly choice as opposed to what the investor would otherwise choose.

All our programmes are described in more detail at [enova.no/esa](http://enova.no/esa).

## Management of goals

Enova follows a goal management model designed to help Enova achieve its strategic goals. The model is used in addition to traditional accounting and financial management. The model lists goals and key figures concerning results and processes within four perspectives: results/economy, customer/market, internal processes/case processing and organisation/working environment. Goal achievement and results are systematically followed up by evaluating results in all units in relation to the goals every quarter.

This process promotes learning and continuous improvement in the organization.

Enova evaluates all policy instruments. The support programmes are often evaluated both during the early phase and at a later stage in the programme's lifetime. The results from these evaluations allow for adjustments, thereby increasing the probability of achieving the desired market change.

## Operationalising the assignment

No-one can accurately describe a low-emission society or guarantee which solutions are worth focusing on today. However, the changes Enova promotes must be relevant on the road toward a low-emission society. As part of our strategy moving forward, we have prioritised six thematic efforts, missions, which will play an important role in the transition.

In order to succeed in our missions, lasting change will have to occur in multiple different markets. A mission can involve changes for one or more sectors, segments or entire value chains. In many cases, Enova's policy instruments are only part of the solution.

In order to prioritise and specify objectives for efforts, we therefore define a set of market change goals.

The market change goals are the point of departure for developing policy instruments, efforts in the markets and for following up the organisation. We prioritise market change goals that allow for optimising the sum of efforts in relation to our objectives. In strategic management, this involves identifying opportunities and making decisions for market change goals that balance the consideration for goal attainment in time, goal attainment within the various sub-goals in the management agreement with the MCE, Enova's appetite for risk and our economic framework conditions.

By systematically following up market developments, and developing risk to reach goals, we have a good point of departure for evaluating and further developing the activities. This involves both continuous assessment of which policy instruments will be best suited to contribute to market change, whether our existing policy instruments should be adjusted or changed, whether new policy instruments should be developed, evaluation and development of market work, as well as a need for organisation development.

## Risk

A strategy has been established for risk management and internal control which provides guidance for the company's general attitudes regarding risk management and internal control. This strategy aims to help Enova reach its set goals, as well as provide sufficient confidence that risk is kept within the framework the Board believes is prudent. The strategy will further ensure that the activities establish and maintain effective risk management processes tailored to the company's nature, size and complexity.

In addition to defining an overall framework and guidelines, as well as delegating responsibilities and authority for risk management, the strategy aims to ensure that Enova complies with statutes, regulations and other external requirements and expectations for good risk management and internal control.

Risk management and internal control is an integrated part of Enova's governance, where the focus on continuous improvement is key in all parts of the process. Among other things, this means that risk management is connected with management by objectives and that risk will be an integrated part of ongoing reporting in the enterprise. Among other things, as a minimum, risk identification is carried out annually at the enterprise and department level, and the risk assessment shall take a point of departure in the company's goals. The process must be forward-looking and must be extensive enough to cover all significant risks the enterprise is facing.

The overall risk assessment is submitted to the MCE in accordance with requirements in the allocation letter.

### **Appetite for risk**

The appetite for risk provides the framework for our work on follow-up and measures to identify risk. Appetite for risk describes the risk the company is willing to accept, and which yields an acceptable balance between risk and expected goal attainment. The Enova Board stipulates the general appetite for risk annually.

### **Important risk factors**

Society and Enova are continually changing. The risk of sensitive business information about projects we support going astray has become a major risk in recent years. Increased focus on technology development and innovation in parallel with an increasing digital threat scenario around the world, sets increasingly stringent standards for secure handling of information. The market must be able to trust Enova to handle business-critical information in a prudent manner.

Verifications and measures were carried out in 2019 to maintain and improve the level of security.

Enova's goal attainment is affected by a number of external risk factors. In order to realise the necessary changes toward a low-emission society, the market must have both the will and ability to invest. If technology development is not taking place at our expected tempo, this could affect the number of projects that can be supported. We have a close dialogue with key players in the various sectors, and closely follow technology development and central framework conditions to detect any needs to adjust our policy instruments. By re-prioritising funds, we can adapt to any unexpected incidents in the market, for example reduced will and ability to invest, and the consequences this may have for Enova's goal attainment.

The present agreement, strategy and policy instruments establish certain changed requirements for expertise in Enova, and this entails a somewhat increased risk associated with

both expertise and capacity. This is taken into consideration in our organisation, thus ensuring that we can always utilise our employees' expertise and capacity. A number of efficiency and improvement measures have also been carried out to release resources. Enova has good experience with utilising the flexibility in our organisation, and encourages internal mobility. Enova underwent a reorganisation in 2019, where the primary objective was to facilitate an innovative and adaptive organisation, which utilises internal expertise and flexibility. We also reinforced the team with relevant expertise through several new hires.

Enova administers substantial public resources, and we depend on trust to carry out our mission. Enova's management works in a goal-oriented manner to ensure that our ethical guidelines, alongside our values, work as guiding principles to stimulate ethical actions. This is a key element in organisational and management development. All new hires complete a training programme in Enova's ethical guidelines during their introduction period.

### **Internal control**

The established control environment and division of labour in Enova provide a good foundation for sound, effective internal control in the enterprise. Different internal control functions have been established with specialised areas of responsibility for following up the projects portfolio, awards via the Climate and Energy Fund and operation of the company. Among other things, verifications are built into systems and routines for project portfolio management and operations in general. In 2019, the focus was bolstered further through increased capacity, as well as establishing roles such as process owner which can follow the entire value chain to a greater extent.

In order to ensure that application processing is carried out in accordance with internal and external requirements, Enova has established an administrative process aiming to ensure quality and independence in the process. The decision-making structure in the administrative process is set up with a point of departure in a risk-based approach and must be tailored to case complexity. In addition to establishing a decision committee (BU) independent of the line organisation and which makes decisions regarding financial transactions in the Climate and Energy Fund, it also makes financial decisions for the executive team and the Board in accordance with established authorisations.

Agreed-upon verification assignments are carried out by an external auditor when necessary for objective and independent assessment of the company. The subjects of these verifications are based on systematic risk assessment throughout year.

The results are included in our work on continuous development and efficiency improvement. In 2019, agreed verification assignments were carried out under the topic of information security. The result showed that Enova generally had the necessary organisational, human and technical frameworks in place in relation to the information we process. Deliberate and

systematic efforts are under way as regards further development, e.g. by updating frameworks and technology in the area, which includes revised governing documents as well as investments in new equipment and infrastructure in connection with moving to new premises in 2019. There has also been extra focus in 2019 on ensuring that the employees have increased knowledge and attention as regards information security.

In 2019, Enova received a clean auditor's report for both management of the Climate and Energy Fund and for Enova SF. No significant nonconformities were identified in connection with the internal control in 2019. Based on the results from external controls over time and follow-up from Enova's own internal controls, Enova is considered to have an expedient internal control process for ensuring responsible and efficient management and operations. Continuous efforts are also under way to improve internal controls in Enova.

## Support system and tools

Enova works continuously and systematically to further develop and improve our administrative and support systems. We focus on reducing paper-based processes, streamlining work processes and utilising shared national IT components where possible.

Enova is carrying out a project for comprehensive enterprise management and organisational development. In 2019, we've worked on enterprise architecture, focusing on how work processes and system support are connected. In this context, we established meeting places to ensure better coherence and utilisation of tools to achieve effective work processes.

We've also worked on how Enova can be a more data-driven organisation and the opportunities this would provide in our commercial and policy instrument development.

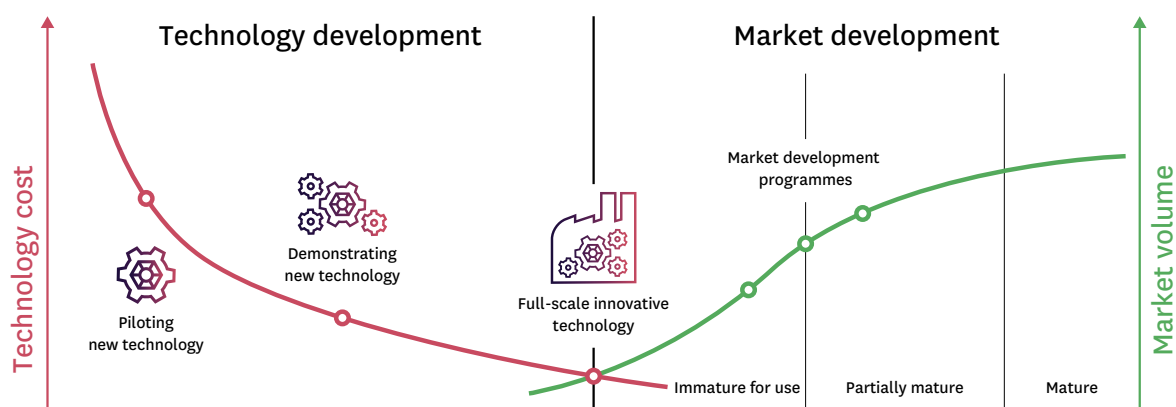
Enova depends on agile and effective collaboration with the market. This sets increasingly higher standards for our digital solutions, which is why we are building the business platform of tomorrow, which will put digital elements at the forefront of our commercial and policy instrument development. Enova's new digital business platform will be our toolbox for digitalisation of energy and climate policy instruments with lasting market change as the end result.

## Enova's policy instruments

Enova's objective has a long-term perspective. As we move closer to a low-emission society, a number of markets will have to change, new ones will be created and others will most likely disappear. We will work to realise market changes where the impact of our expertise and instruments is greatest. When new policy instruments are developed, they are therefore based on an assessment of goals, potentials, drivers and barriers in the different markets.

Enova's foremost policy instrument is financing. By providing investment support, and loans in some cases, we reduce the costs and risk for both the providers of efficient energy and climate solutions and those who demand them. And by highlighting what is possible while simultaneously spreading experience, we reduce the risk and make it easier for the next group to make good energy and climate choices.

**Figure 4.1**  
Technology development and market development



The development of new energy and climate technologies is necessary in the transition to a low-emission society, but this demands more than the actual process of development. New solutions will not take us into the future if they are not used. Many of the technologies we will use moving forward are already well-known today, but are not used widely enough.

We therefore need goal-oriented measures that satisfy the needs of players at their stage of development, whether this involves the first testing or the last obstacle before the technology is taken up on the market and establishes itself as a standard.

Enova therefore has a broad range of support programmes. We mainly work along two main lines: technology development and reduced technology cost/increased performance on the one hand, and market development and volume on the other, as illustrated in Figure 4.1.

The technology programmes will contribute to reducing the technological risk and cost of new innovative energy and climate technology, so that more energy and climate technologies are assisted from the development stage and out into the commercial market.

The market development programmes will help known technologies that are not widely used to test the market and

contribute to development. The time it takes to create lasting changes can vary significantly from sector to sector, and between segments and technologies within a sector. The way in which different markets develop depends both on the players themselves and a number of framework conditions that influence them. In order for the market to choose to focus on sustainable solutions, it must see a long-term potential for value creation in replacing the fossil alternatives with zero-emission solutions. The transition to a low-emission society depends on good interaction between the market, Enova and other public policy agencies. Enova's role is to break down barriers and influence drivers so that the new solutions are demanded and used in the market on a large scale. This means that we can take part in the development process up to when the market has sufficient momentum to continue driving the development alone or together with regulatory and economic instruments, such as taxes and fees.

Information and advice are Enova's other important policy instruments. Familiarity with and expertise in the different markets allow Enova to provide advisory services and information to players. In small projects, we provide advice through Ask Enova, and through advice and guidance online. In large projects, we work closely with players over time, allowing the projects to benefit from the expertise and experience of Enova employees, which they have gained by managing a portfolio comprising several thousand projects.

## Key elements in case processing

Enova evaluates submitted applications related to the offered programmes and follows up projects that have been approved for investment support or a loan.

In the following we will describe a few key methods/elements in case processing associated with applications and project follow up.

### Evaluation of immature technologies and innovation projects



The Technology Readiness Level (TRL)<sup>16</sup> and *Commercial Readiness Index* (CRI)<sup>17</sup> are vital in the work on assessing the degree of maturity for technologies in innovation projects.

*Technology Readiness Level* (TRL) is a widely used method for analysing technology maturity. Maturity is assessed on a scale from 1 to 9, where the levels reflect the various development stages that a technology must complete on the road from basic research, via lab testing and demonstration, until the technology is introduced in the market. Although various technologies

could be verified and ready for commercialization, they could have a different point of departure for competing on commercial market conditions, depending on costs and market maturity. This can be highlighted by supplementing the TRL rating with a so-called *Commercial Readiness Index* (CRI). CRI provides a broader assessment, which includes the technology's maturity, robustness in the cost assessments and financial terms, as well as the market maturity with regard to the player and competitive situation on the supply and demand side. The connection between TRL and CRI is shown in Figure 4.2.

<sup>16</sup> Developed by NASA – National Aeronautics and Space Administration in the US.

<sup>17</sup> Developed by Arena – Australian Renewable Energy Agency.

**Figure 4.2**  
Technology maturity

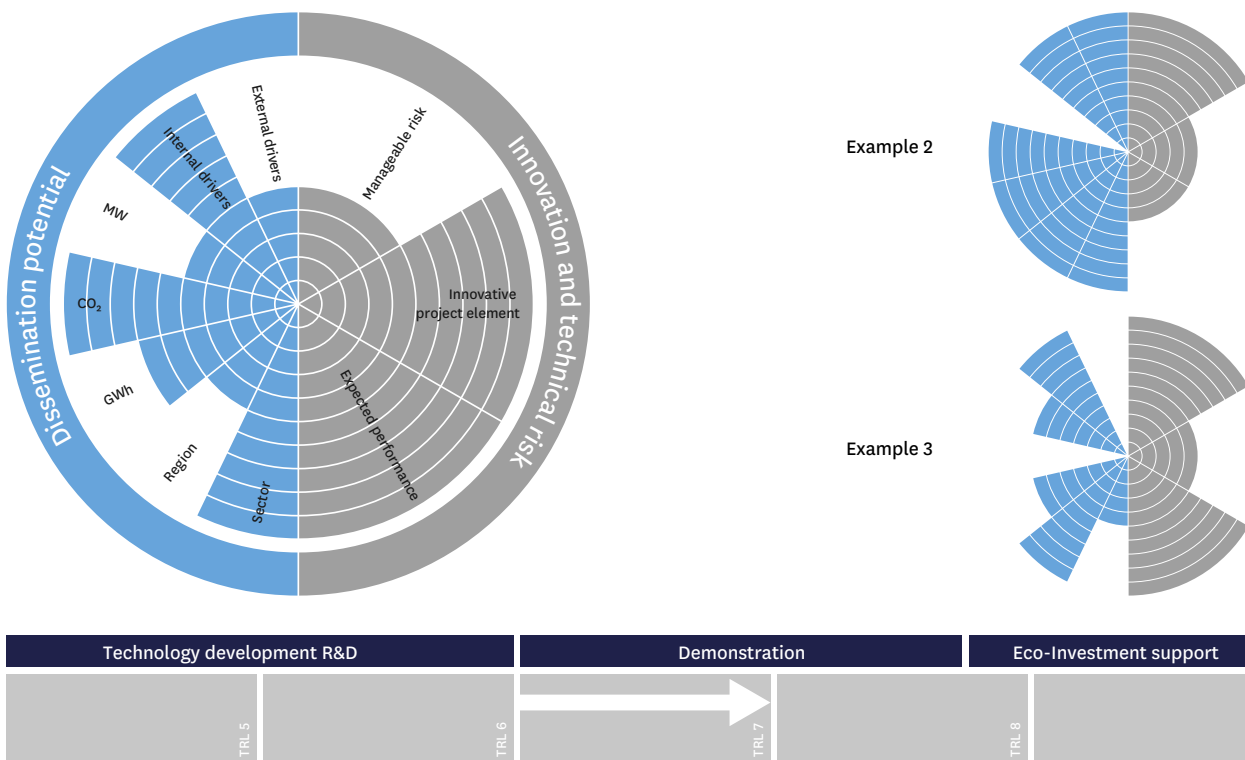
		<b>CRI</b>	
		6	Market-based and "bankable"
		5	Market competition, significant dispersion
		4	Diverse commercial applications
	<b>TRL</b>	3	Commercial scale-up
Commercial technology	9	2	Commercial testing
Market introduction	8		
Demo and pilot	7		
Experimental development	6	1	Hypothetical commercial proposal
	5		
Research and development	4		
	3		
	2		
	1		

Source: NASA, ARENA

Technology development projects are unique, and Enova therefore conducts project-specific assessments of, among other things, level of innovation, technological risk and proliferation

potential. If necessary, third party reviews are used in the assessments. Figure 4.3 shows elements emphasised in the assessments.

**Figure 4.3**  
Assessment elements in potential and risk



**Figure 4.3:** The figure shows examples of elements emphasised in the assessments.  
Source: Enova



## Measuring quantitative results and documentation



In the application for support from Enova, the applicant must describe the result it expects to achieve if the project is implemented. The results can either be **climate results** (in the form of reduced greenhouse gas emissions), **energy results** (in the form of conserved energy or transition to renewable energy) or **reduced peak demand results** (in the form of reduced peak loads in the power grid).

Climate results and energy results are often closely correlated, while this is less the case for reduced peak demand results. The climate result takes a basis in standardised emission factors for the different energy carriers in the project. The results are reported in CO<sub>2</sub> equivalents, which indicate the combined effect of all types of greenhouse gases. Enova deduces and reports such results, in addition to the result that is agreed with the applicant. Technology development projects might have a major potential for energy and climate results, but they are first dependent on successful innovations and the direct results are often modest. For such projects, Enova primarily measures **innovation results**, in the form of triggered private capital.

Enova quality-assures the result that the applicant has described as part of the case processing procedure. If established standards exist, they are used. For example, we use a standardised method for calculating energy consumption in buildings as a basis for estimated energy results for programmes within buildings. In other cases, Enova uses empirical data from our extensive project portfolio. In some cases, particularly in connection with large projects, we use a third party assessment to verify the expected energy result.

The support recipient reports results to Enova at three different times:

- when the contract is signed
- in final reporting to Enova and
- generally three years after final reporting.

Upon Enova's request, the subsidy recipient shall cooperate with Enova on performance monitoring and evaluation of the project for a period of up to ten years after the final report is submitted.

### Contractual result

Upon entering into a contract, the support recipient pledges that the project will achieve a future result, for example an energy result. This pledge is quantified in the funding commitment letter. The contractual energy result is an estimate of the expected annual energy result after the project is completed. Completing a project can take several years. Enova records the results from the project in the

year the support is granted. This provides quicker reporting and enables closer follow-up from Enova. The results are then updated as the projects are completed. If the project follows the progress plan, support is disbursed in arrears in accordance with incurred costs. Material deviations from the agreement could result in Enova demanding repayment of all or parts of the support amount.

### Final reported result

When the project is completed, the project owner must submit a final report. The final report summarises the project and contains an up-to-date prognosis of expected realised annual climate, energy or reduced peak demand result. Documentation requirements are contingent on the size of the subsidy.

If the subsidy exceeds NOK 1 million, the final progress and accounting report must also be confirmed by an auditor. Enova assesses whether the final reported energy result is reasonable, and whether documentation is sufficient. The final support amount is disbursed when the final report is approved.

## Realised result

Final reported projects are followed up with measurement and verification of the results three years after the final report was submitted. For a selection of the largest projects, Enova uses third-party assessment to quality-assure the reported result.

While the contractual and final reported energy results are based on expectations, the realised results are also based on observations.

## Quantifying support and triggering funding level



Two main principles form the basis for our assessment of the funding level in projects in line with the requirements in guidelines for state aid:

### Necessary support

A fundamental principle for subsidising projects through various types of support is that support changes behaviour. For our projects, this entails that the project owner will choose a more energy, climate or demand-friendly project with the benefit of support than the project owner would

choose without support. In other words, Enova cannot support measures that the project owner will have to carry out for other reasons, for example due to regulation. This also means that we cannot support projects that have already been implemented.

### Sufficient support

The support must be sufficient to trigger changed behaviour. This entails that Enova must assess how much support is needed to trigger the project. If the funding level is too low,

the project will not be carried out. If the funding level is too high, the project received more than necessary to change behaviour.

## Method for assessing profitability



The basis for assessing necessary and sufficient support is a profitability assessment of the projects. The method used for the assessment is a standard net present value assessment, where the project-specific risk is reflected in the cash flows while the return requirement must reflect the applicant's market risk. This approach forms the basis for all ordinary support measurement in Enova, but the application will vary somewhat depending on the market and project size.

### Information asymmetry

When assessing necessary and sufficient support, Enova and the project owner will always have different information. This applies to technical and financial details in the project, as well as knowledge about the market in which the project takes place. Enova aims to minimise this information asymmetry as much as possible during the case processing by obtaining information from the project, and also sharing knowledge that Enova has

gained in connection with the project. External third-party assessments are also used if necessary.

### Template versus project-specific assessment

Obtaining and assessing details and comprehensive information about technical and financial factors related to individual projects is very costly for both the project owner and Enova. In some markets, the potential volume of measures is significant, but each measure is relatively small. For certain project types, having programmes that are based on template assessments based on standardised values for a set of measures is more expedient.

This makes the services offered to the market simpler, and reduces the costs related to documentation. In turn, this makes it easier to supply the market, reduces costs associated with documentation and automates case processing to a significant extent.

### Reasonable returns

In order to ensure the support is sufficient for the projects to be completed, the project owner must consider the gains of the project to be higher than the costs. In other words, the present value in the project must be positive, based on the company's

required rate of return. The required rate of return thus affects the level of funding needed to trigger projects.

In the assessment of what is a reasonable required rate of return, Enova applies the required rate of return used by the enterprise in other corresponding projects or the requirement that can otherwise be documented as necessary to trigger the investment. If this information is not available, the required rate of return that is considered normal for the sector in question is used.

In order to determine various sectors' normal rate of return, Enova takes a point of departure in a third-party assessment. Because different sectors have different degrees of associated risk, the reasonable rate of return could vary.

### Major projects

For the largest projects, Enova carries out very thorough analyses of the project economy. This includes sensitivity analyses, assessment of market position and potential strategic assets in the projects. Third party assessments of critical factors for the project economy are also obtained for major projects. This may include perspectives regarding future price development for intermediate goods and products, and a reasonability assessment of the energy result.





# PART V

# ASSESSMENT OF FUTURE PROSPECTS

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## Necessary changes toward a low-emission society

The world is not emitting greenhouse gases just for fun. Emissions are the result of activities we, as people, depend on, such as production and consumption of goods, and transport of both people and freight. It takes a lot of energy to run a society, and global population growth and economic growth will continue to increase demand for goods and services that require energy. Despite the growth in renewable power generation, the percentage of renewables in the world's overall energy mix is still modest.

As economic growth gives rise to increased energy consumption, and as energy generation and consumption are associated with considerable greenhouse gas emissions, the emissions will continue to grow unless additional measures are carried out.

No-one can know in detail what a modern low-emission society will look like, but the presumption is that this will require a transition from fossil to renewable solutions. In order to spare the globe from the worst consequences of climate change, the emissions of greenhouse gases must be reduced toward or below zero. This is not impossible, but requires a transition the likes of which the world has never seen. Such a transition will consist of

large and small changes, where much can be done quickly, while other changes require long-term efforts.

Norway must also do its part, and has committed to cutting greenhouse gas emissions by 40 per cent by 2030 compared with 1990, and by at least 80 per cent by 2050. In 2020, the Government announced that it was raising its level of ambition further, to 50–55 per cent emission cuts leading up to 2030.

Norway will be realising this in parallel with creating new values, because a low-emission society must be more than merely a society with low emissions. In order to simultaneously protect the current welfare state, we will have to find other ways to cover large parts of our energy demand. This means that the products and the services the markets provide will have to have considerably lower carbon footprints in the future.

Norway is transitioning to a low-emission society it will be good to live in. Now we are facing a decisive decade, where measures in each individual year will be important for the result. In order to reach this goal, we have to work with market players and the range of policy instruments, cooperate and be a team player.

## Enova – working with the market

Enova has been given a key role in driving the necessary changes in the markets that will take Norway in the direction of a low-emission society. This is based in the market, and will require efforts throughout the broad range of sectors in Norwegian business and industry. In order for the market to choose to invest in sustainable solutions, the players must see a long-term valuecreation potential in replacing fossil alternatives with renewable solutions. Here Enova will contribute to ensure that new energy and climate solutions are developed, put to use and eventually preferred on the market.

In order to succeed with this long-term work, we will have to identify concrete changes that must occur on the way there, and translate these general changes into effort and targeted activities that trigger necessary actions in the right markets.

The transition to a low-emission society will require considerable resources and investment needs are high. The finance industry has a significant impact on which projects and companies receive

funding or not, e.g. based on an assessment – and the price of – risk in projects and companies. This means it will be difficult to realise the necessary transition without the finance market contributing in an effective manner through climate-competent capital, which entails shifting the capital represented by the finance market from "brown" to "green" investments. Enova will contribute to elevating the focus on and familiarity with climate risk in financial markets.

Enova has a particular focus on driving changes within the markets of Industry, Transport, Energy system, Non-residential buildings and property, as well as Households and consumers. When we are open to all types of technology innovation, our priorities will not be limited to specific technology development processes or technology areas.

This will afford Enova the flexibility to contribute toward realising the vast and important projects as they arrive.

# Industry



In the process industry, current production processes have chemical limitations that restrict how low the emissions can be, from a purely mathematical standpoint. In order for the industry to be virtually climate neutral by 2050, we need entirely new production processes. The majority of the necessary emission cuts can be solved with mature technology, and presumes primarily that the technologies are profitable investments. However, about 40 per cent of the necessary emission cuts depend on the development and implementation of new solutions not currently on the market, and which are still somewhat lacking in form. It is simply not enough to streamline current production processes. The innovation processes that will lead to competitive solutions on the market will also take a long time. In order to succeed by 2050, it is therefore critical that the necessary innovation processes for zero-emission technologies start now.

Moving forward, Enova will contribute to more rapid introduction of new energy and climate technology in the industry by supporting projects from the pilot phase in the development process to full-scale implementation.

Our support must provide risk mitigation for demanding technology development cycles and stimulate toward a reduction in technological risk before the businesses incur a considerable financial risk. We will also work for efficient energy use in the industry, as well as reduced greenhouse gas emissions. Important steps to achieve this are reducing the use of fossil energy carriers for heat production and contributing to the further development and implementation of technology for utilization of waste heat from industrial processes.

In order to realise these objectives, Enova is engaged in a close dialogue with key players in Norwegian industry and cooperates with other public policy agencies, such as the Research Council of Norway and Innovation Norway.

Enova is aware that a number of factors could affect the development. Economic cycles and commodity prices affect the industry's ability and willingness to invest. In addition, national and international framework conditions, such as customs tariffs, import regulations and EU regulations can affect the countries in which international players choose to invest both as regards technology development and production.

## Moving forward, Enova will prioritise efforts to:

- demonstrate technologies for zero and low-emission process industry
- demonstrate energy-efficient technologies and solutions for renewable energy consumption in industry
- introduce (and increase the volume of) energy-efficient technologies and solutions for renewable energy consumption in the industry

# Transport



Enova wants to contribute to assist the transport sector in changing and moving in the direction of the low-emission society through development and cost reductions throughout the value chain for battery-hybrid and battery-electric solutions. At the same time, there will be a need for multiple types of technologies and energy carriers, such as electricity, hydrogen and biogas. We will therefore also support demonstrations of zero emission technologies and solutions for biogas for relevant vehicles within freight transport on roads, as well as testing of innovative distribution solutions.

Norway is a major maritime nation where the entire maritime value chain is represented, including shipping companies, shipyards and equipment suppliers. Here we have a unique position to influence technology development on a global scale and, over time, change

the market for zero-emission vessels. This is a golden opportunity to create considerable values for Norway by providing the solutions the world needs.

Norway is leading by example internationally for the transition to emission-free passenger transport, and we have to build on this experience. We can play an equivalent role within heavier means of transportation for both people and freight. Norway has a challenging topography and climate, and being able to demonstrate that zero-emission solutions also work in the cold north could influence foreign markets to more rapidly utilise such solutions. In other words, while the maritime sector in Norway has a role to play in building the supply side for tomorrow's solutions, our role in the onshore part might be our primary contribution to create demand.

In order to ensure that zero-emission solutions are utilised, the infrastructure for alternative fuels will have to be economically sustainable, and there must be well-functioning value chains from production and distribution to use.

Enova is aware that certain elements could affect this development. For most transport segments, particularly road transport, Norway is dependent on international technology development. Changes in the global markets have a substantial impact on the pace of development in the Norwegian transport sector.

### Moving forward, Enova will prioritise efforts to:

- develop technology and mature hydrogen solutions for demonstration
- contribute to a functioning market for battery electrification at sea, and on land
- contribute to efficient logistics systems enabling the transition to zero and low-emission solutions
- develop a functioning market for biogas and biofuels

## Energy system



Better interaction between the power system and thermal energy systems will contribute to a cost-effective and flexible energy system. In addition to reducing the need for electricity by using other types for heating, it is also positive for security of supply because it provides multiple legs to stand on.

So far, the market has all but lacked the mechanisms to steer or shift consumption. Electricity prices have been the same hour by hour, and customers have not been charged based on their own demand consumption. In addition, electricity has been relatively cheap in Norway, which limits the incentives for or profitability of carrying out measures to reduce demand consumption. Peak demand pricing will be a reality in 2021, but the impact of this is still uncertain.

Enova is cooperating with the Norwegian Water Resources and Energy Directorate (NVE) to examine the possibilities in the regulations as regards triggering desired changes. In order to establish requirements through regulations, it must have been proven that new solutions work and are robust. Enova will contribute to this by alleviating the risk for the players who want to develop and use new technology, new solutions and new business models to utilise and bolster flexibility in the energy system.

The transition to a low-emission society, regardless of which solutions and options are chosen, will be contingent on an underlying energy system that enables the necessary changes. For now, there is significant uncertainty surrounding which technologies and business models will be necessary in tomorrow's energy system and to what extent. Different solutions must be tested on the road towards a low emission society. This is also reflected in our programmes for the energy system sector. Enova's efforts will support the other sectors' needs associated with power supply, reduced greenhouse gas emissions, reduced peak demand, improved energy efficiency and increased production of energy from renewable sources. We will emphasise large-scale demonstrations of business models and technologies that contribute to this.

Contributing to the development of an energy system tailored for a low-emission society is a long and demanding process. This process must start now. Enova maintains a close dialogue with key players in the sector such as NVE, Statnett and industry organisations such as Energy Norway and the Norwegian Smartgrid Centre, as well as close collaboration with other public policy agencies such as the Research Council and Innovation Norway.

### Moving forward, Enova will prioritise efforts to:

- contribute to a well-functioning market and solutions for flexibility



# Non-residential buildings and property



The construction sector must contribute to the low-emission society by reducing both energy consumption and demand consumption in Norwegian buildings. This is why it is important that the sector learns of the financial and commercial opportunities inherent in applying a comprehensive perspective including both climate, energy and effect. The sector's contribution will start as early as in the choice of materials for construction, and continues with operation of the buildings, rehabilitation and all the way to reuse when the building is demolished.

Going forward, the development must be toward buildings with low energy consumption, where buildings jointly utilise solutions within exchange of energy and load balancing, thus ensuring that energy resources and systems are utilised in the best possible way. With the goal of limiting their carbon footprint, the leading innovators must go the extra mile and use the building

infrastructure – such as ceilings, walls, foundation, systems and outdoor areas – to produce and store energy from locally available renewable sources.

It is also possible to utilise structural tendencies such as increased urbanisation. For example, we are seeing an increasing number of multifunction buildings with both shops, offices and residences, which will provide even more opportunities to utilise the energy inside the building. For instance, waste heat from the refrigerated cases in the grocery store on the ground floor can be used to heat water for the flats on the top floor.

Enova has extensive experience with policy instruments aimed at the construction and property sector. These experiences, along with analyses of which barriers, drivers and opportunities are found in the market, make up the point of departure for the priorities moving forward.

## Moving forward, Enova will prioritise efforts to:

- contribute to a well-functioning market for climate-friendly construction processes and materials
- contribute to a well-functioning market for services that trigger demand and energy measures in buildings
- contribute to normalising a high energy ambition when buildings are retrofitted

# Households and consumers



Households play a crucial role in the transition to a low-emission society. The choices that every household makes, through homes, transport needs and consumption, influence national and international greenhouse gas emissions and security of supply for energy. Enova will contribute to ensure that private individuals in the low-emission society live and transport themselves in a climate-neutral manner, with minimal strain on the power system.

The majority of Norwegian homes are still single family houses, and a significant share was built with poorer energy standards than what follows from current requirements for new construction. In other words, there is a potential for retrofitting these to a substantially improved energy quality. Buildings with a low heating demand are very significant for the energy and demand load in the power grid, particularly during winter. Enova will stimulate making energy upgrades with a high energy ambition the standard for retrofit projects.





# PART VI DIRECTORS' REPORT AND ANNUAL ACCOUNTS FOR ENOVA SF

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This part is not translated,  
see Norwegian version at [enova.no](http://enova.no)





# PART VII

# ANNUAL ACCOUNTS FOR THE CLIMATE AND ENERGY FUND

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see Norwegian version at [enova.no](http://enova.no)



# PART VIII

# APPENDICES

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79 Definitions and terminology



## Definitions and terminology

### CO<sub>2</sub> equivalent

The greenhouse effect from CO<sub>2</sub> is used as a unit of measurement to describe the greenhouse effect of different greenhouse gases. The greenhouse effect from other greenhouse gases is converted to CO<sub>2</sub> equivalents in accordance with their global warming potential (GWP) over a given period. The GWP value for a gas is defined as the accumulated impact on the greenhouse effect from a one-tonne emission of the gas compared with a one-tonne emission of CO<sub>2</sub> over a specified period of time, usually 100 years.

### Reduced peak demand results

Enova can record reduced peak demand results for projects that result in a reduced peak demand and increased flexibility in the power system. This includes measures that can limit winter loads and reduce short-term peaks. Reduced peak demand results are measured in kilowatts (kW).

### Energy result

The energy result is a goal for what the projects we support will deliver (per year) through more efficient energy consumption, increased production or increased use of renewable energy. Energy results are measured in kilowatt-hours (kWh) per year.

### ESA

ESA is the abbreviation for the EFTA Surveillance Authority. The EFTA Surveillance Authority ensures that the EFTA nations, Iceland, Lichtenstein and Norway, comply with their obligations under the EEA Agreement. The EFTA Surveillance Authority also enforces the general ban against state aid, and assesses national support programmes vis-à-vis the EEA rules and has the authority to demand that illegal support be returned.

### Renewable energy

Enova uses the same definition of renewable energy used in the EU's Renewables Directive (2001/77/EC). In the directive, renewable energy is defined as renewable, non-fossil energy sources (wind, solar, geothermal energy, tidal energy, hydro-power, biomass, gas from landfills, gas from cleaning facilities and biogases). Biomass is furthermore defined as biologically degradable fractions of products, waste and agricultural remnants (plant or animal-based), forestry and associated industries, in addition to biologically degradable fractions from industrial and municipal waste.

### Innovation results

Enova records innovation results from projects that contribute increased innovation within energy and climate technology. Innovation results are measured in triggered capital in kroner. Triggered capital means the part of the project's investment costs that is triggered through the support from Enova, which is investment costs less support from Enova and other public policy instruments.

### The Climate and Energy Fund

The purpose of the Climate and Energy Fund is to contribute to reduced greenhouse gas emissions and strengthened energy security of supply, as well as technology development that also contributes to reduced greenhouse gas emissions in the longer term.

The Fund is based on Section 4-4 of the Act relating to amendment of Act No. 60 of 29 June 1990 relating to the generation, conversion, transmission, trading, distribution and use of energy, etc. (Energy Act), cf. Odelsting Proposition No. 35 (2000-2001) and Recommendation to the Storting No. 59 (2000-2001). The Ministry of Climate and Environment (MCE) determines the statutes for the Climate and Energy Fund.

The Climate and Energy Fund is financed through grants in the Fiscal budget and a parafiscal charge on the grid tariff for withdrawing power at all grid levels.

Up to and through 2017, the grants to the Climate and Energy Fund mainly consisted of returns from the Fund for climate, renewable energy and energy restructuring. Starting with 2018, the Fund for climate, renewable energy and energy restructuring will be phased out and the transfer to the Climate and Energy Fund will be replaced with an ordinary item of expenditure in the Fiscal Budget.

### Climate result

A climate result is calculated for each project supported by Enova. The climate result corresponds to the total change in greenhouse gas emissions as a result of various measures in the project. The calculation uses emission coefficients for the different energy carriers involved as a basis. The climate result is measured in tonnes of CO<sub>2</sub> equivalents per year. The conversion to tonnes of CO<sub>2</sub> equivalents takes place using internationally recognized GWP factors (Global Warming Potential).

## Contractual result

Contractual result is an annual result expected to be realised in the future from a project, and which is included as part of the contractual basis between the support recipient and Enova. All decisions within a calendar year are included in the calculation of gross contractual result for the year in question.

## Market change

Enova defines market change as the change Enova will help drive within a given market. This entails a permanent shift in supply and/or demand for products that have a place in a low-emission society.

## Market change goal

In order to reach Enova's objectives and realise our missions, we must identify concrete changes that must occur on the way. These are concrete changes for a sector, a segment or a value chain. Enova defines this as market changes with an associated market change goal. Multiple market change goals could form the basis for each mission.

## Missions – thematic prioritisations

In its strategic choices leading up to 2050, Enova has prioritised a set of thematic focus areas we believe will play a decisive role in achieving the transition to a low-emission society. We call these thematic focus areas missions.

## Programmes

Enova has chosen to focus the use of policy instruments through programmes. A programme is an instrument directed towards one or more specific target groups, with set application criteria.

## Realised result

Achieved results are based on measurements or updated estimates once measures have been carried out and an effect of the measure can be observed. It takes time from when the measures are implemented until achieved results can be reported.

## Final reported result

The final reported result is an updated forecast of a project's expected achieved annual result. Enova undertakes a reasonability assessment of the final reported result from support recipients.

## Triggering effect

As an administrator of public resources, it is important for Enova to ensure that the resources we manage are used in the best possible manner. Support from the Climate and Energy Fund must contribute to realising projects that would not have been realised otherwise. For example, projects with a low cost per generated or reduced kWh will often be profitable by themselves, and therefore do not require support from the Climate and Energy Fund. Support is also considered to be triggering if it advances a project in time, or if a project has a larger scope than it otherwise would have had.





# ENOVA

Enova works to promote Norway's transition to the low emission society. The transition will require us to cut greenhouse gas emissions, safeguard security of supply and create new values. That is why Enova works to bring the good solutions out in the market and contributes to new energy and climate technologies.

Enova's reports can be found at [enova.no](http://enova.no)

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