

# ENOVA

Annual Report 2018



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*For information, se Norwegian version.*

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# Seize the opportunity!



**The world has thirty years to reduce emissions of greenhouse gases by at least eighty per cent. This is the great challenge of our time, a shared global issue with a clear prescription for considerable transitions in each individual country, including Norway. Because even Norway isn't emitting greenhouse gases just for fun. The greenhouse gas emissions are being driven by the demand for goods and services on the markets, which is why the markets are also the answer. This is where new technology, new services and new business models must be developed and utilised, thus creating new values and cutting emissions.**

Regardless, we must transition as a nation. So we would be smart to do this in a way that simultaneously stimulates the Norwegian private sector and creates new values for us leading up to 2050 and beyond. This is where Enova comes in, by helping to trigger projects, investments and actions that, over time, will create ripple effects in the markets – lasting changes that will endure in a low-emission society.

TNS Kantar recently conducted a survey on our behalf showing that 84 per cent of the population supports the Norwegian climate goals, but only 25 per cent are confident that we will reach them. This is a challenge for Norway, because doubt rarely leads to action. The task before us is complex and

considerable, so the doubt can be understandable, but we cannot afford – and no longer have the time – to face this task with passivity or a fear of failing. Inaction is also a risk.

Where some people see challenges, others will fortunately see opportunities. And where some people stand around waiting for the rest, others will fortunately take the lead. At Enova, we have the pleasure of working with passionate players in both the public and private sectors every single day, who not only support the transition toward a low-emission society, but who want to make a positive contribution in this direction. Here we play the role of both challenger, partner, advisor and risk mitigator, depending on what is needed to drive the good initiatives from the drawing board to reality.

In 2018, we gave funding commitments amounting to about NOK 2.1 billion for a total of 987 energy and climate projects in Norwegian enterprises and 14 487 energy measures in Norwegian homes. There is a steady stream of activity from across the country – as usual, we are taking part in projects in every single county. Although we would like to have seen more major projects, it is worth emphasising that every little bit helps. This indicates that knowledge and expertise from the experiences of those who lead the way in testing new technology and new solutions will also benefit the rest of the market,

and we have to see even more of this. Because even though it is crucial to have someone blaze the trail, it is equally important for the rest to follow suit. Trains are made up of many carriages, not just locomotives, and lasting market changes are precisely about seeing movement in the large masses as well.

The largest nominal funding commitment of the year was NOK 101.5 million to the Rockwool factory in Moss. Even as a low-emission society, Norway will be dependent on vibrant industry, but in order for the industry to be emission-free in time, the innovation tracks toward new production processes without emissions will have to start now. There are still too few such initiatives in the sector, but one of them is found at Rockwool. Here the mineral wool manufacturer will be cutting more than 80 per cent of greenhouse gas emissions from its factory with the aid of new technology that makes it possible to replace coke as a source of energy with electricity.

In addition to industry, the other big train for us in 2018 was the transport sector, particularly maritime industry, where batteries were the recurring theme of the year. There is now a high level of activity on the battery front in the construction of a Norwegian value chain in the area. In 2018, we therefore sharpened the focus of the programme Energy and climate measures in ships, where we provide support for utilising familiar technology that cuts greenhouse gas emissions and energy consumption, and we now require that the project include the installation of batteries in order to gain support from us. Last year's flagship in the maritime project portfolio is the Havila Kystruten project, where we are supporting a number of energy efficiency measures with nearly NOK 88 million. Their four new coastal express vessels will use both LNG and batteries, and the shipping company has an aggressive ambition for its vessels to eventually be the first zero-emission vessels in their segment. Just a few years ago, future visions such as this seemed like unrealistic pie in the sky dreams. Thanks to joint efforts from the broad range of the Norwegian maritime value chain, they are fast becoming concrete plans.

“ We now report to a cross-sectoral ministry responsible for following up Norway's climate targets ”

Electrification is a necessary and key aspect of the transition to a low-emission society, but this also entails increased strain on our energy system. We are therefore working to ensure that Norway's renewable and robust energy system is able to deliver predictable and secure access to electricity also in the future, without having to solve the entire challenge through costly grid

upgrades. In 2018, in an effort to trigger the necessary innovation in the energy industry, we launched concept assessment support for buildings and area development. We hope this will stimulate increased interaction and energy exchange between buildings, energy systems and transport solutions. We also announced a large-scale demo competition with the aim of cultivating innovative projects that build flexibility in the future energy system.

The construction sector is another important piece of the energy system puzzle. Due to the high percentage of electric heating in Norway, energy use in buildings makes up a significant part of the demand load. In order to reduce energy consumption and peak demand in our buildings, we need profitable solutions and business models that can free up energy, and this development is currently too slow. In 2018, we therefore launched new support programmes to increase the pace of innovation in the sector. Among other things, we want to support assessments of various concepts and business models for energy services that can trigger our vast potential for reduced energy and demand consumption in Norwegian buildings.

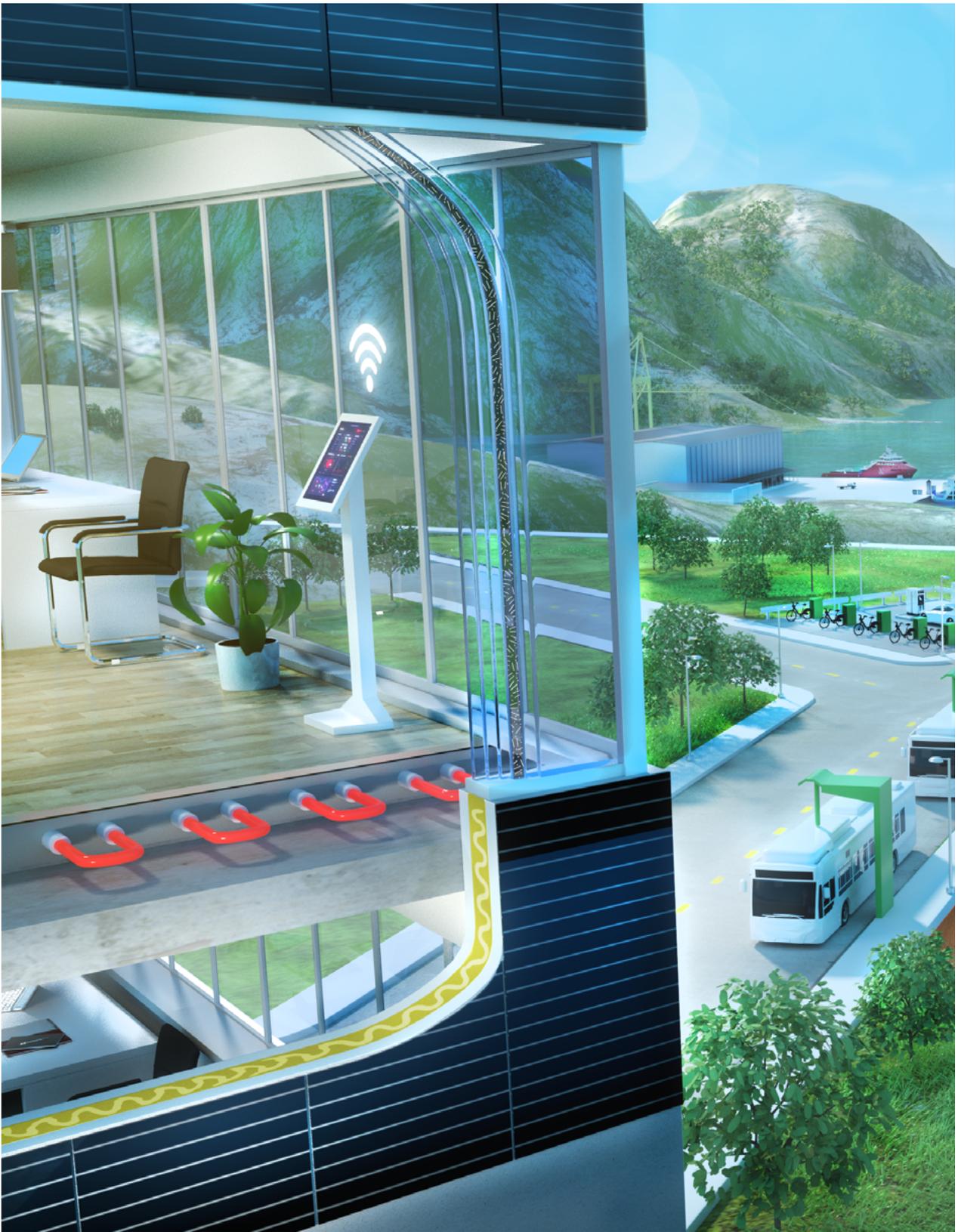
The Enova Subsidy, our subsidy scheme for homeowners, experienced considerable growth in 2018. From 2017 to 2018, overall disbursements increased from NOK 165 million to NOK 275 million, driven by a considerable growth in the interest in phasing out oil tanks and oil boilers. Fossil-fuel heating will be prohibited in Norway as of 2020, and it is encouraging to see that so many homeowners are taking the opportunity to replace their oil furnace with modern, renewable heating solutions.

Enova's ownership was moved to the Ministry of Climate and Environment in 2018. We now report to a cross-sectoral ministry responsible for following up Norway's climate targets. Enova will be an important tool to help Norway deliver on its climate commitments and reach these targets, and in 2019 we will continue our work to shift the market standard. The transition to a low-emission society through lasting market changes is a considerable endeavour that depends on the efforts of and collaboration between many parties. Enova will do its part and contribute toward making it attractive and profitable to develop and utilise the technologies and services needed to take the necessary steps toward a low-emission society.

Very few places in the world are better poised to create value through transition than Norway. Now is the time for each and every one of us to make a specific commitment as to how we will contribute to this transition – and then seize the opportunity.



**Nils Kristian Nakstad**  
Chief Executive Officer (CEO)



# **PART II**

# **INTRODUCTION OF THE ORGANIZATION AND KEY FIGURES**

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# Social mission

Enova SF is a state enterprise located in Trondheim. As part of the Jeløya declaration from January 2018, the Government agreed to move the ownership of Enova SF from the Ministry of Petroleum and Energy (MPE) to the Ministry of Climate and Environment (MCE) as of 1 May 2018.

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:

- Reduced greenhouse gas emissions that contribute to fulfilling Norway's climate commitment for 2030.
- Increased innovation within energy and climate technology adapted to the adjustment to the low-emission society.
- 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 organization.
- We exercise corporate governance and management principles which emphasize openness, transparency, responsibility, equality and long-term perspectives.
- We set high integrity requirements, 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 good listeners in communication and contact with the outside world.
- We do not discriminate based on gender, sexual orientation, 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 Development and Marketing Departments

Leistad has been the Director of the Development Department since 2013. In 2018, he also held the position of Marketing Director. Leistad has an educational background in resource economics, financing and investment from the Agricultural University of Norway. He was hired by Enova as a senior adviser in 2005. From 2007-2012, he was the Director of the Energy Production Department in Enova. Leistad has experience from the Ministry of Petroleum and Energy, where he worked with administration of various policy instruments related to stationary energy supply and renewable energy, and energy efficiency in particular. He is a member of the programme board for ENERGIX in the Research Council of Norway.



## **Gunn Jorun Widding**

Director of Enterprise Management

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.



## **Stein Inge Liasjø**

Director of Strategy and Communications

Liasjø has been the Director of Strategy and Communications since 2016. He has an educational background in economics, financial management and media studies from the Norwegian University of Science and Technology in Trondheim and the University of Oslo. Liasjø has previous experience from Aker Solutions, where he held various management positions within communications and finance from 2004. From 2010 to 2014, he was posted in China as country manager for Aker Solutions. Liasjø has board experience from multiple companies.

# Organisation

Enova has been entrusted with administering considerable State resources in a manner that yields the greatest possible benefit for society. This sets requirements and expectations for us as an organisation and how we operate.

Enova depends on the individual employee's knowledge and ability to interact internally and externally to reach our goals. In order to succeed, we work to build the individual's strengths and desire to perform at their peak. These values determine how we must act with each other and when we meet other people and players. As an organisation, we depend on trust, and therefore want the market to perceive us as credible and competent. Our tasks must be carried out in an orderly and professional manner, where the administration of the Climate and Energy Fund is in accordance with objective and transparent criteria.

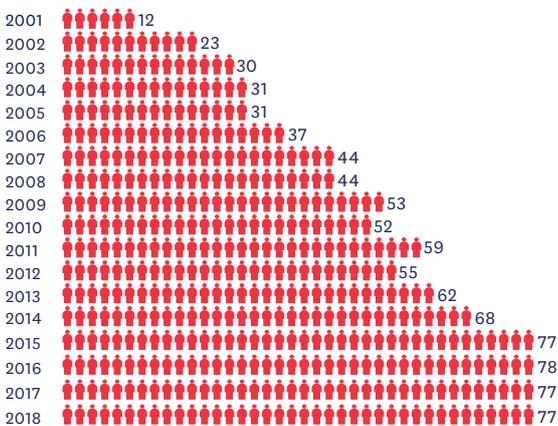
At Enova, we value strengths-based management and work to integrate the values and confidence of the individual employee in all parts of the workday, as regards both decisions, behaviour, priorities and participation. Working for Enova must be perceived as meaningful, regardless of your position and duties. In order to succeed with this, we must ensure that we can interact well internally, and that we are utilising our employees' expertise in combination with well-run, smart systems and processes. Enova works in a goal-oriented manner to be an attractive workplace. Through the employee survey, the employees report that they largely identify with Enova's goals, and through involvement want to contribute to continuous learning and development in the best interest of the organisation. Maintaining a flexible and adaptable organisation is a criterion for success. It enables

us to quickly adapt to changing needs and new focus areas. Throughout the year, we worked to develop a new strategic system, revise the corporate strategy, adapt our policy instruments and identify the need for expertise. As we move into 2019, we are working to adapt our team configuration to be even better at delivering on our social mission.

Enova has 77 permanent employees, divided among 36 women and 41 men. The 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 utilise different perspectives. The enterprise is organised in four departments, each with special tasks and responsibilities:

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

## Development number of employees

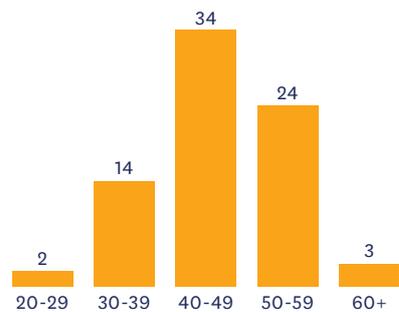


47%  
Women



53%  
Men

## Age composition



# Key figures

## Key figures for Enova SF

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

Key figures	2018	2017	2016	Description
Full-time equivalents	73,5	75,2	79,8	Full-time equivalents 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)	146,2	140,3	129,9	Total allocation consists of administration remuneration, as well as earned equity at 1 Jan.
Utilisation rate	100 %	93 %	96 %	The utilisation rate is calculated as total operating expenses as a percentage of the administration contribution.
Administration contribution (NOK million)	124,0	125,2	120,8	The MCE stipulates a framework for administration remuneration 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	71 %	69 %	71 %	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 remuneration. Payroll costs include all social costs (incl. pension costs).
Payroll costs per full-time equivalent (NOK)	1 204 587	1 145 443	1 067 796	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	9,7 %	4,9 %	6,1 %	The percentage of consultants in the administration contribution consists of purchase of consultancy services, as a percentage of the administration remuneration.

## Key figures for the Climate and Energy Fund

Key figures	2018	2017	2016	Description
New commitments (NOK MILLION)	2 326	2 582	2 570	New commitments show how much Enova has allocated from the Climate and Energy Fund to support projects, contractual activities and administrative remuneration.
Disbursed from the Climate and Energy Fund (NOK MILLION)	2 356	2 356	2 151	Disbursed from the Climate and Energy Fund shows how much has been disbursed to projects, contractual activities and administrative remuneration. Disbursements were made during the year to projects adopted during the period 2008-2018.
Added to the Climate and Energy Fund (NOK MILLION)	2 792	2 659	2 290	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	987	931	1 008	Number of projects allocated support from the Energy Fund, except measures funded through the Climate and Energy Fund.
Number of disbursements from the Enova Subsidy	14 487	8 123	6 468	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 must be a flexible and adaptable organisation that manages state resources in the most efficient manner possible. This also entails that operation of Enova and administration of the Climate and Energy Fund must be as cost-effective as possible, thus ensuring that the resources, to the greatest possible extent, are used to reduce greenhouse gas emissions, strengthen the security of supply for energy, as well as technology development that contributes to reduced greenhouse gas emissions over the longer term.

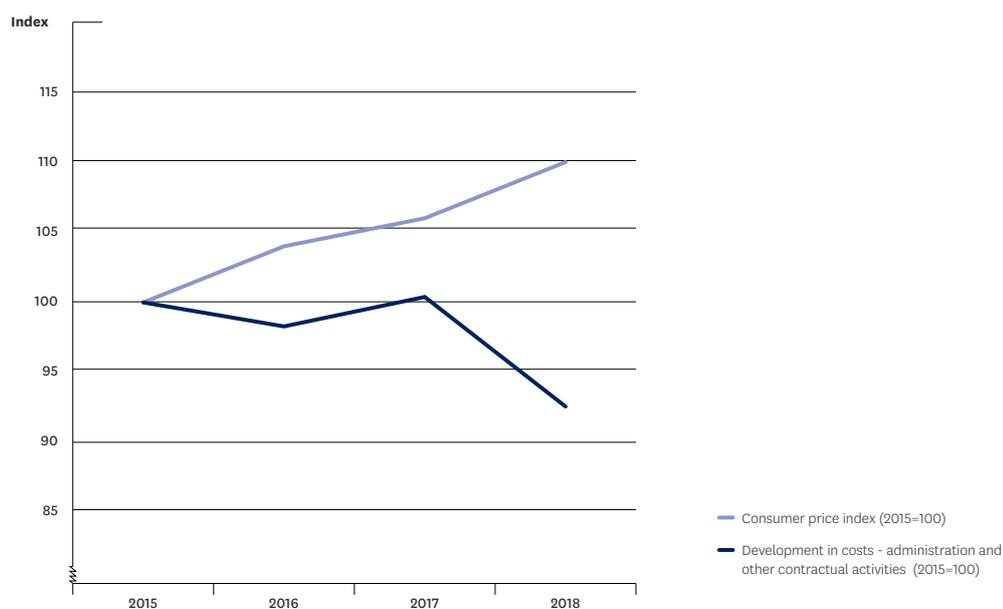
Enova has prepared 4 indicators in order to monitor the extent to which the Fund is administered in a cost-effective manner. Beyond investment and feasibility study support for projects,

funds from the Climate and Energy Fund are allocated to other contractual activities and administration remuneration. The framework for administration remuneration is stipulated by the Ministry in annual allocation letters to Enova.

Figure 3.1 shows the development in these costs compared with the development in the consumer price index since 2015, and shows that costs associated with administration of the Climate and Energy Fund – contractual activities and administration remuneration – show a positive trend measured against the consumer price index during this period, in addition to a cost level reduction in recent years.

**Figure 3.1**

Development in costs for administration remuneration and other contractual activities in relation to the 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 2015-2018 period. (2015 = 100)

In recent years, Enova has laid down considerable efforts toward digitalisation and automation of simple case processing actions, which means that manual case processing is used more sensibly for complex projects and to handle an increasing number of applications.

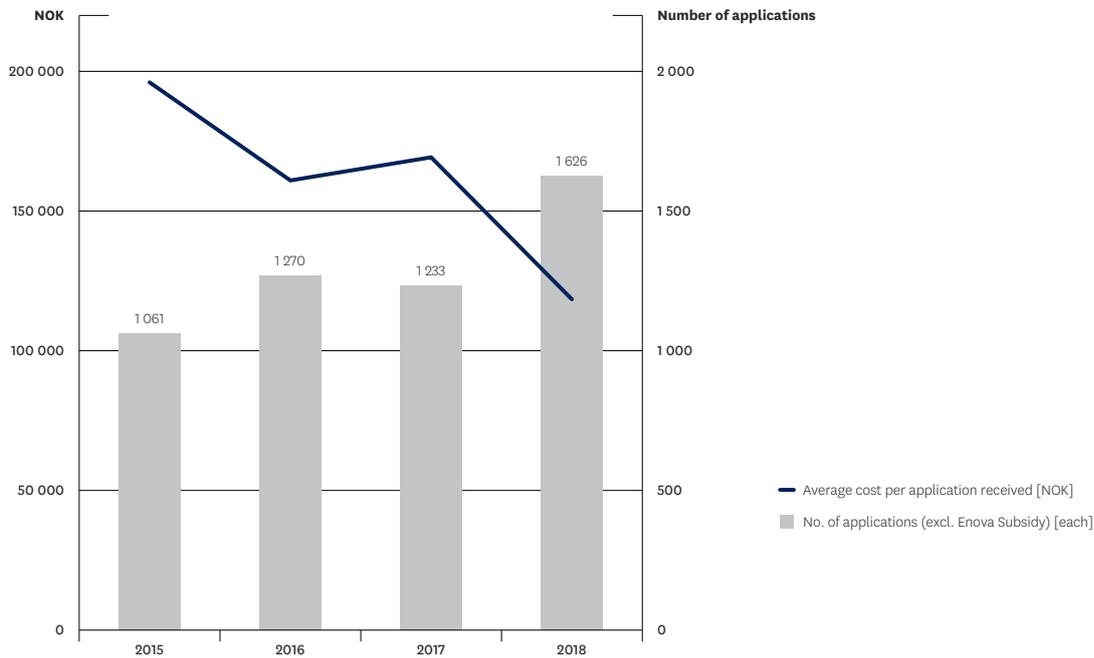
Figure 3.2 shows costs for administration and other contractual activities distributed by number of applications received. Decisions associated with the Enova Subsidy are not included in this presentation. The figure shows that the average cost per

received application has been reduced by 60 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 years, this ratio has been around 8 per cent. The ratios are affected both by the cost levels, but to an equal extent by the size of the annual allocations made from the Fund. If we only look at administration remuneration, the ratio has remained at a level between 4.0 and 5.1 per cent during these years.

**Figure 3.2**

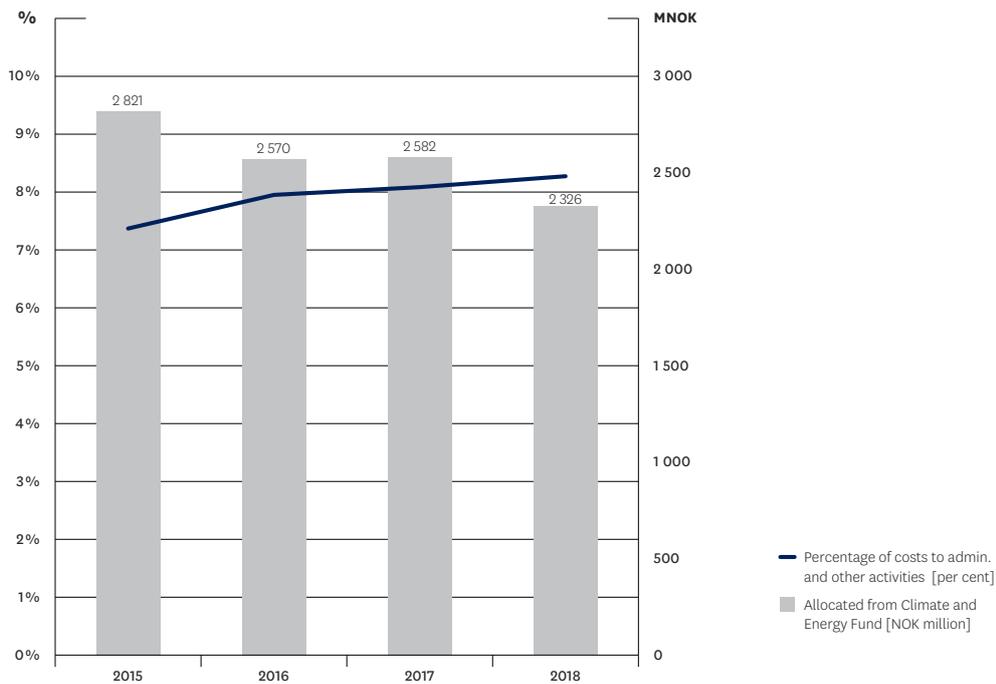
Development in costs for administration remuneration and other contractual activities per application received



**Figure 3.2:** The figure shows the development in average costs for administration and other contractual activities per application received during the 2015-2018 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 remuneration and other contractual activities by total allocated funds in the Climate and Energy Fund



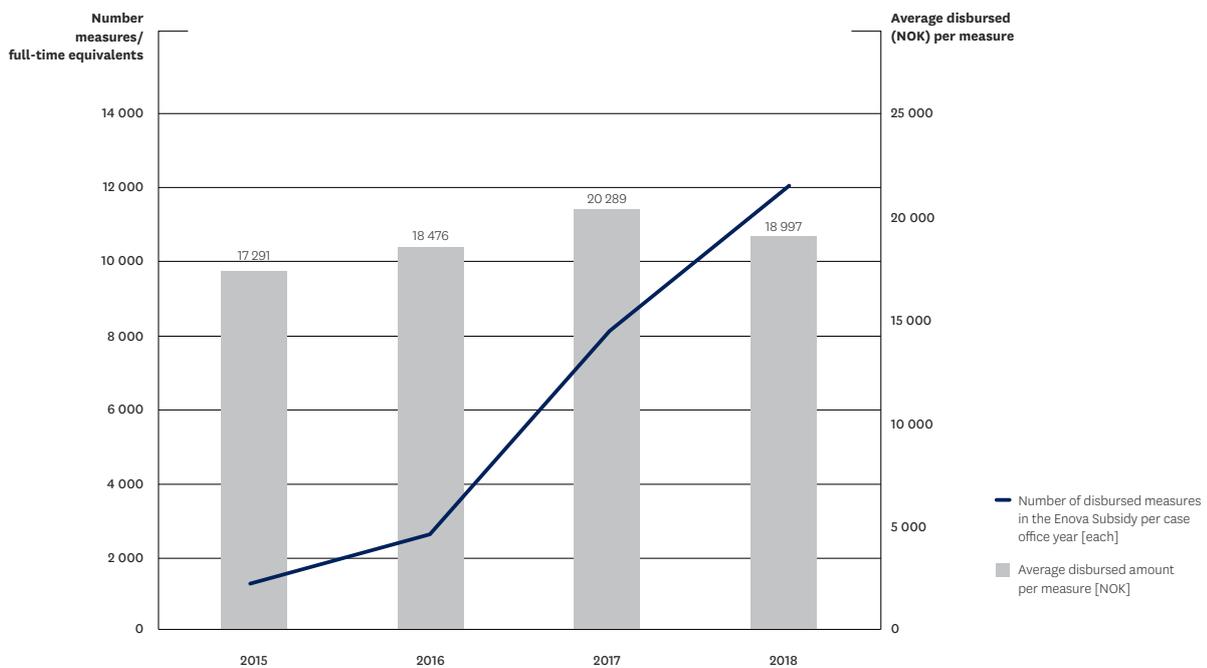
**Figure 3.3:** The figure shows the ratio of costs for administration remuneration and other contractual activities of the total allocated funds from the Climate and Energy Fund 2015-2018.

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 – and particularly in 2018.

The figure below shows the development in the number of processed cases per full-time caseworker equivalent within this scheme, and average amount per case.

**Figure 3.4**

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



**Figure 3.4:** The figure shows the average number of measures processed per full-time equivalent used to process these applications in relation to the average amount disbursed per measure during the 2015-2018 period.

## PART III B | Reporting on the Climate and Energy Fund 2018

# Objectives

Enova works to create market change for the solutions that will take us to the low-emission society. Market change has occurred when technologies and solutions are utilised to a significant degree, without public subsidies. This entails that how a project contributes to market change becomes just as important as the individual project's quantifiable result 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 prioritize projects that yield reduced greenhouse gas emissions. The transport sector represents about one-third of Norwegian greenhouse gas emissions. The sector will therefore be particularly important to Enova in the work on adapting to the low-emission society. As regards facilities subject to carbon credits, the EU Emission Trading System 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 diffusion 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, particularly measures that lower electricity consumption during winter, 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. The market change we will contribute to, is a situation in which fossil-free solutions outstrip fossils based on performance, quality and price. Then we will know for sure that we are moving towards a society that is also financially sustainable.

# Missions toward a low-emission society - contributions from the 2018 results

Enova has prioritised six thematic focus areas, missions, which we believe will play a decisive role in achieving the transition to a low-emission society;

- The market chooses zero-emission vessels
- The market chooses zero-emission vehicles
- The market chooses zero-emission industry
- The market chooses to use energy and resources efficiently
- The market chooses to utilise the flexibility in the energy system
- The market chooses to utilise renewable resources

This is described in more detail in Part V Assessment of future prospects.

In order to succeed in attaining the missions we have laid out, projects must be realised which contribute on the road toward permanent change in the market. Enova is on the right track and the results from 2018 provide a good contribution.

As regards zero-emission vessels, Enova provides investment support both for measures in the vessels, for infrastructure for emission-free maritime transport and for technology development. In 2018, Enova has contributed more than NOK 500 million in investment support for more than 50 different projects. These projects are expected to reduce greenhouse gas emissions by nearly 60 kilotonnes of CO<sub>2</sub>-equivalents.

Enova also provided support for 40 energy management projects on vessels that are expected to reduce greenhouse gas emissions by more than 90 kilotonnes of CO<sub>2</sub>-equivalents. For example, in 2018, we supported more than twenty battery projects in vessels, which have helped ensure that battery solutions approach the point where they are competitive without support.

Within zero-emission vehicles, Enova saw a considerable increase in the number of projects in 2018. Enova provides investment support for measures in ground transport, for emission-free ground transport infrastructure, technology development and production of biogas and biofuels. In 2018, Enova provided investment support for both electric, biogas and hydrogen vehicles, for electric vehicle infrastructure (passenger cars, buses and construction machinery) and for hydrogen and biogas infrastructure. Overall, more than 60 projects were allocated close to NOK 240 million in investment support. These projects are expected to reduce greenhouse gas emissions by 20 kilotonnes of CO<sub>2</sub>-equivalents. We also supported about 50 energy management projects within ground transport which are expected to contribute an additional 12 kilotonnes of CO<sub>2</sub>-equivalents. In 2018, new technology in multiple segments which demonstrate that the technology works, changed the market in the sense that more players will have the opportunity to utilise the technologies and more suppliers can develop and deliver them.

Zero-emission industry is an important contributor on the road to a low-emission society. The development tracks are typically long and Enova's primary focus is support for technology development and introduction. Enova can contribute investment support in the pilot stage, for demonstration and/or full-scale testing of the technology. For a long-term, demanding goal such as zero-emission industry, the number of new projects is an indication that

the market is shifting. In 2018, Enova provided more than NOK 250 million in funding commitments for 3 major and 14 small and medium-sized technology projects. These projects are expected to trigger close to NOK 400 million in private capital.

All sectors have a potential for using energy and resources more efficiently. In 2018, Enova has supported more than 560 large and small projects that, overall, are expected to contribute energy efficiency measures equivalent to 1.1 TWh. These projects are found in all sectors.

A flexible and secure energy system is crucial for the transition to a low-emission society. Enova contributes to this by stimulating the development and use of new technology and new services while at the same time continuing to contribute toward development in the thermal energy system and interaction between energy systems. In 2018, Enova provided funding commitments for investment support totalling NOK 160 million for district heating projects and technology projects aimed at the energy system. In addition, close to 40 projects have received support for concept assessments in new construction and areas that also contribute to developing the future energy system. Overall, the projects for which Enova has allocated investment support in 2018 will contribute to reducing peak demand in the electrical grid by 123 MW.

Enova must contribute to ensure that new solutions and technology to increase the production of renewable power and other utilisation of renewable resources are developed and utilised. Through projects adopted in 2018, Enova will contribute to generation and distribution of renewable power totalling about 0.2 TWh. The projects also contribute more than 0.25 TWh of energy converted from fossil energy carriers to zero-emission solutions.

## Goal achievement in 2018

2018 has been a banner year, and we are well on our way with deliveries after completing the first half of the 2017–2020 contractual period. We see that several markets are changing, with a large number of projects that contribute to reduced costs, increased expertise and reduced risk for those that are utilizing the solutions. We are also seeing more technology development projects capable of demonstrating that change is possible.

In 2018, Enova has also adjusted the design of its support programmes in line with the prevailing management agreement. In 2018, Enova received nearly NOK 2.8 billion and has granted support amounting to more than NOK 2.3 billion to about 1,000 energy and climate projects. We have also supported more than 14 000 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. As one of many guidelines in the work to spur the development towards the low-emission society, we presume that the four contractual performance indicators will provide us with an indication of whether we are prioritising our efforts correctly and whether we are achieving our goals.

The following level is presumed for the performance indicators for the agreement term 2017-2020:

- climate results corresponding to 0.75 million tonnes of CO<sub>2</sub> equivalents in the sector not subject to carbon 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 2018, Enova recorded 0.24 million tonnes of CO<sub>2</sub> equivalents in climate result, 1.6 TWh in energy result, 123 MW in reduced peak demand result and triggered NOK 1.2 billion in private innovation capital. Enova finds that the results in 2018 are good

for all performance indicators as compared to the contractual levels for the contractual term. Table 3.1 shows results for the four performance indicators for 2017 and 2018, respectively.

**Table 3.1**

Performance indicator results 2017-2018

Performance indicator	2017	2018	Total
Climate result (ktonne CO <sub>2</sub> -eqv.)	287	242	529
Energy result (GWh)	1 693	1 561	3 255
Reduced peak demand (MW)	133	123	256
Triggered innovation capital (NOK million)	1 620	1 197	2 817

**Table 3.1:** The table shows results for the four performance indicators, defined in the agreement with the Ministry of Climate and Environment, for projects awarded support during the 2017-2018 period. The figures have been corrected for cancelled and final-reported projects as of 2018.

## The Climate and Energy Fund – allocations in 2018 and further development

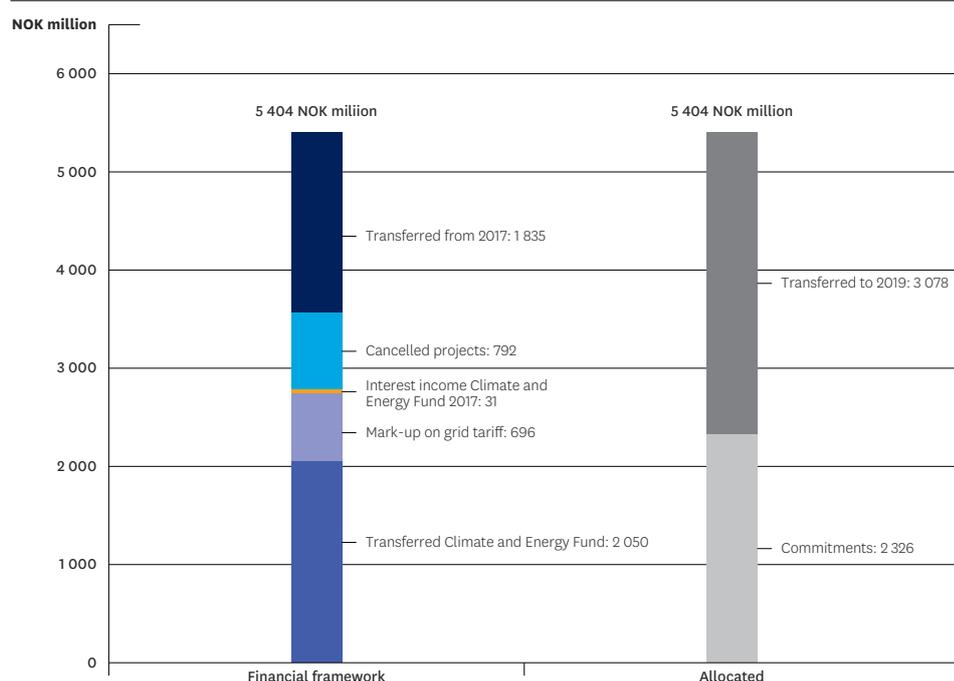
New funds are added to the Climate and Energy Fund every year. The revenues come from appropriations via the Fiscal Budget, a mark-up on the grid tariff and interest income from the resources in the Fund. Overall, these revenues amounted about NOK 2.8 billion in 2018.

Enova can also allocate funds transferred from previous years,

as well as returned funds from cancelled projects. These items constituted just over NOK 2.6 billion in 2018. Enova thus had an overall framework of NOK 5.4 billion at its disposal in 2018. 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 2018



**Figure 3.5:** The figure shows a comparison of the Climate and Energy Fund's different sources of revenue and allocations thereof. Projects approved and cancelled in 2018 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.

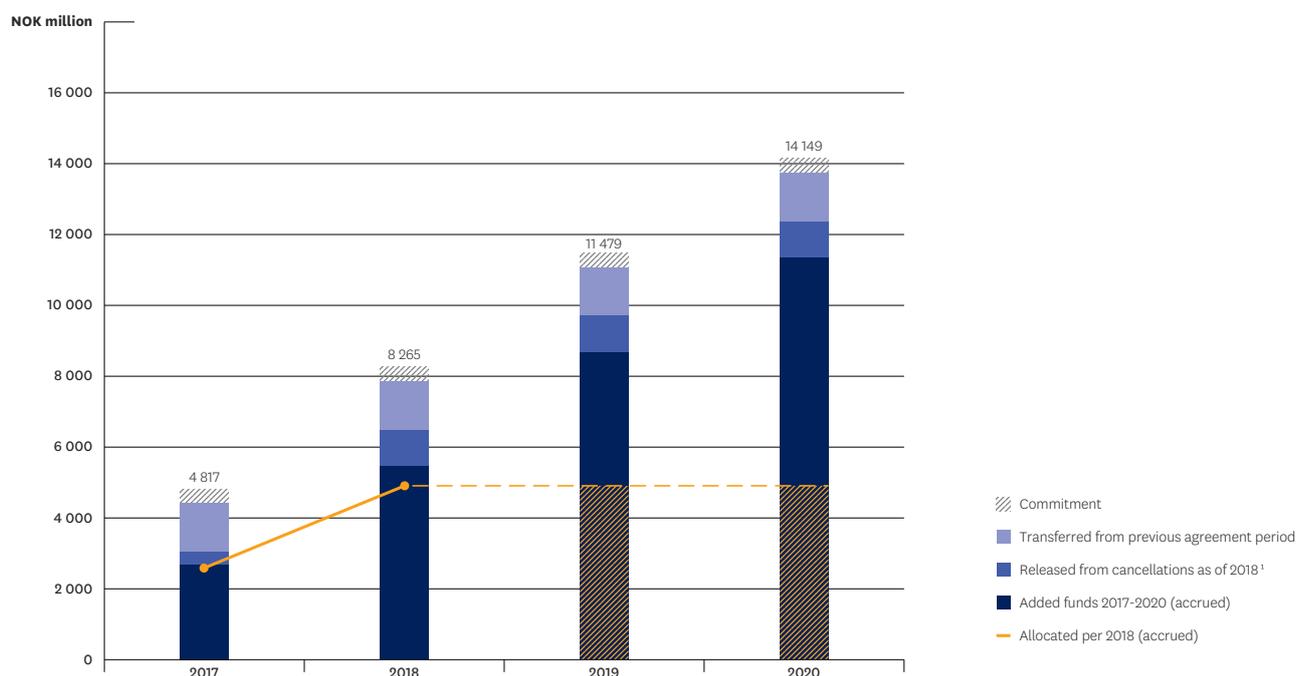
Enova's ability to transfer unused funds from one year to the next is one of the Climate and Energy Fund's strengths. This provides a flexibility that is particularly important for major, capital-intensive individual projects. These are projects where Enova normally maintains a close dialogue with the 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 possibility of transferring funds gives the players assurance that the time of application and decision will not impact the outcome of the case processing.

Figure 3.6 shows an overview of allocated funds in 2017 and 2018, and the development in expected available funds for the contract term 2018-2020.

**Figure 3.6**

Allocations and 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 and 2018, as well as the expected development (cumulative) in available funds in the Climate and Energy Fund during the 2018-2020 period. Added funds in 2019 are in accordance with the Fiscal Budget and added funds in 2020 are in accordance with the agreement between Enova and the Ministry of Climate and Environment.

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

Enova has granted funding commitments amounting to NOK 2.1 billion to projects in 2018. These projects are expected to trigger just under NOK 7 billion from the market. This will yield a total investment of about NOK 9 billion in projects approved in 2018. NOK 220 million of this is linked to Enova's annual administration remuneration for management of the Energy Fund and other contractual activities.

Support totalling about NOK 800 million was allocated for 203 projects within the transport sector in 2018. This amounted to just under 40 per cent of total allocations. Transport is the sector with the greatest potential for implementing climate measures outside

the sector subject to climate credits. The transport projects constitute about 3/4 of climate results in 2018, but also contribute a highly significant share of results within energy and innovation.

Non-residential buildings and property is the sector in which the most projects received support in 2018. Support was provided to a total of 556 projects, of which support for heating plants constitutes 201 of these. Overall, non-residential buildings and property received nearly NOK 450 million in support, which amounts to 21 per cent of total allocations. The individual projects are small, but overall, this sector contributes particularly well to security of supply and somewhat to innovation.

**Table 3.2**

Climate and Energy Fund's allocations

Sector/activity	2017	2018	Total
	NOK million	NOK million	NOK million
Industry	431	407	838
Transport	992	817	1 809
Energy system	192	160	352
Non-residential buildings and property	429	444	873
Households and consumers	165	275	440
International	2	4	6
Counselling and communication	54	45	99
External analyses and development measures	40	20	60
Administration remuneration	157	155	312
<b>Total</b>	<b>2 461</b>	<b>2 326</b>	<b>4 787</b>

**Table 3.2:** The table shows funds allocated from the Climate and Energy Fund during the 2017-2018 period distributed by sector as well as other contractual activities and administration remuneration. The figures have been corrected for cancelled and final-reported projects as of 2018.

Support was granted to 191 industrial projects in 2018. The total support amounted to more than NOK 400 million, and totalled 19 per cent of the overall project allocation. This sector is very relevant to Enova's objectives, and has a significant potential in all of the secondary goals, and particularly within innovation and security of supply. The industry projects supported in 2018 provide good contributions toward all measurement indicators. This sector is the second-largest contributor in climate, innovation and energy results.

Projects that contribute to further developing the energy system have received support totalling NOK 160 million in 2018, which constitutes 8 per cent of allocated funds. Of the 34 projects that received support, 26 are district heating projects. This sector contributes the greatest reduced peak demand results in Enova's portfolio, and is the sector that contributes the most to pure strengthening of Norway's security of supply.

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 13 per cent of allocated funds in 2018. The rights-based subsidy scheme for homeowners is showing good progress, and with 20,000 applications in 2018, the number of applications increased by 127 per cent from the previous year. Disbursements have increased from NOK 165 million to NOK 275 million. A fully-digital application process makes it easy for homeowners to register measures and receive subsidies. User surveys show that users are very satisfied with the programme.

## Activity overview

Table 3.3 shows an overview of all applications in 2018, including the Enova Subsidy. A total of 21,863 applications were received in 2018, and 15,474 projects were supported.

In certain instances within a year, there could be more decisions than applications for a programme. 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.

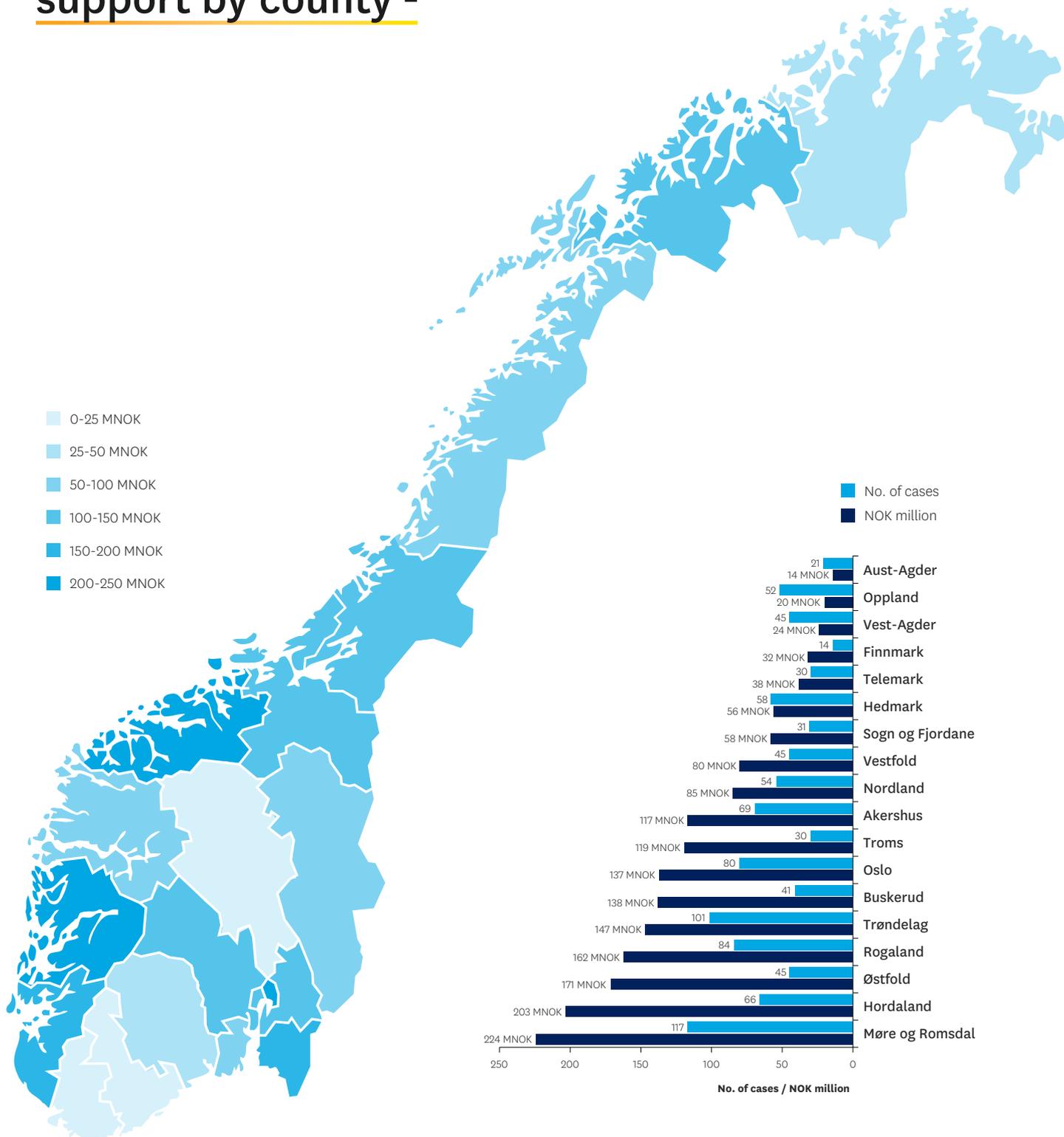
**Table 3.3**

Activity overview for the Climate and Energy Fund 2018

Sector	No. of applications	No. of projects supported	Contractual support
	stk	stk	MNOK
<b>Industry</b>	<b>347</b>	<b>191</b>	<b>407</b>
Pilot testing of new energy and climate technology in industry	6	4	8
Demonstration of new energy and climate technology	3	2	28
Full-scale innovative energy and climate technology	13	8	197
Pre-project support for new energy and climate technology in the industry	8	3	23
Support for energy and climate measures in industry and plants	113	70	120
Pre-project support for energy and climate measures in the industry	4	3	1
Support for introducing energy management	200	101	29
<b>Transport</b>	<b>452</b>	<b>203</b>	<b>817</b>
Pilot testing of new energy and climate technology in transport	5	1	8
Full-scale innovative energy and climate technology	6	4	46
Support for energy and climate measures in ships	38	30	276
Electrification of maritime transport	10	1	1
Support for energy and climate measures in ground transport	32	21	53
Hydrogen infrastructure	6	4	24
Onshore power for ships in Norwegian ports	21	15	131
Support for infrastructure for municipal and county authority transport services	11	7	187
Support for charging infrastructure for electric cars (rights-based)	35	29	8
Support for introducing energy management	287	90	45
Support for production of biogas and biofuel	1	1	39
<b>Energy system</b>	<b>58</b>	<b>34</b>	<b>160</b>
Demonstration of new energy and climate technology	2	2	7
Full-scale innovative energy and climate technology	9	6	39
Large-scale demonstration and pilot project unit	15	0	-
Support for district heating	32	26	115
<b>Non-residential buildings and property</b>	<b>773</b>	<b>556</b>	<b>444</b>
Introduction of new technology in buildings and areas	35	29	102
Commercial testing	9	7	12
Innovative solutions in the Energy service market for buildings	30	10	8
Support for energy-efficient new buildings	0	3	26
Support for new technology for the future's buildings	2	0	-
Best available technology in existing buildings	155	92	92
Comprehensive mapping of buildings	32	19	3
Mapping support for existing buildings	21	20	2
Support for existing buildings	184	138	147
Support for concept assessment in new construction and areas	61	37	25
Support for heating plants	244	201	28
<b>Households and consumers (the Enova Subsidy)</b>	<b>20 230</b>	<b>14 487</b>	<b>275</b>
<b>International (IEA Main Project)</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>Total</b>	<b>21 863</b>	<b>15 474</b>	<b>2 106</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 2018. The table only shows support for eligible programmes, and not allocations for other contractual activities in the Climate and Energy Fund.

# Distribution of projects and contractual support by county <sup>1</sup>



In 2018, Enova supported more than 980 projects with a total of NOK 1.8 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> The Enova Subsidy is not included in the overview

# 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. Two per cent of the projects that were granted support in 2018 have started receiving disbursements, but have not submitted final reports yet. These projects are relatively large and constitute 16 per cent of total granted support, cf. Figure 3.8.

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 7 per cent of the projects supported in 2018 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, at about 1 per cent of the overall support approved in 2018. This is natural, since the smallest projects are more likely to be completed during the same year that they received support from Enova.

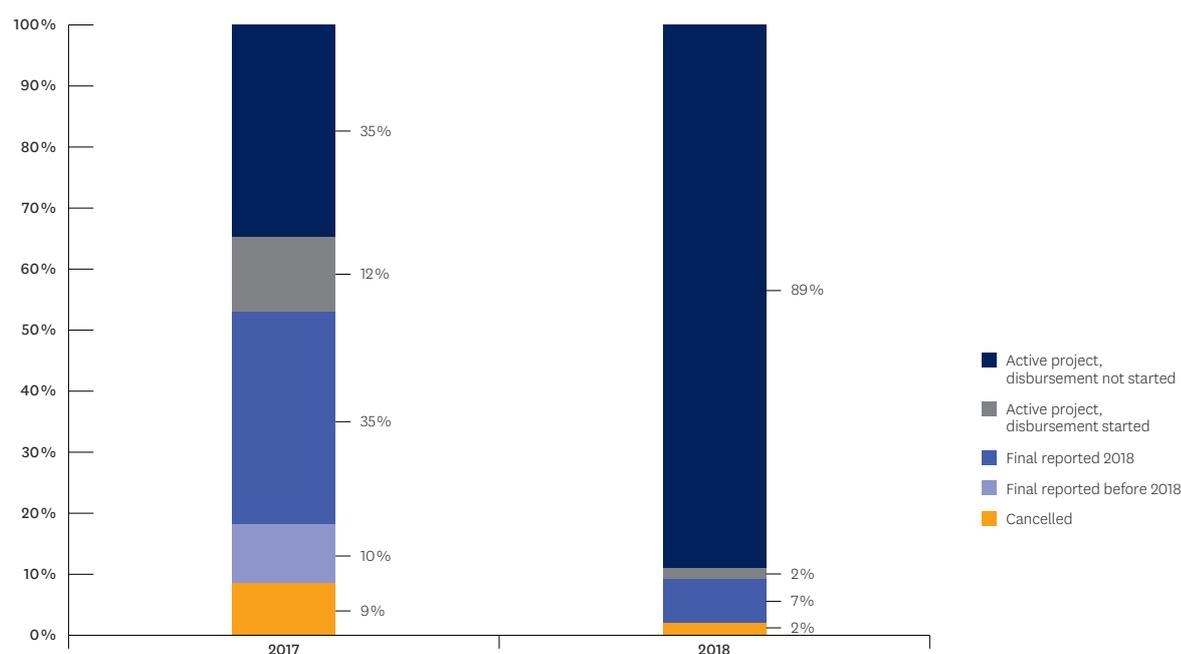
Most projects are active. This means that a support decision has been made and that the project is not finalised. At year-end, this accounts for about 90 per cent of the 2018 project portfolio.

Some of the projects that receive support are cancelled, often due to changed preconditions that affect the project during the period from when the application was submitted until the start-up decision. Only 2 per cent of the projects were cancelled over the past year, and they only represented 1 per cent of the total granted support. 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 2017 portfolio, 45 per cent of projects were complete by the end of 2018; they constitute about 11 per cent of awarded support in 2017. Investment decisions and start-up of the largest projects often takes a long time. 35 per cent of projects from 2017 are still active without starting disbursement. These projects make up more than one-half of awarded support in 2017.

**Figure 3.7**

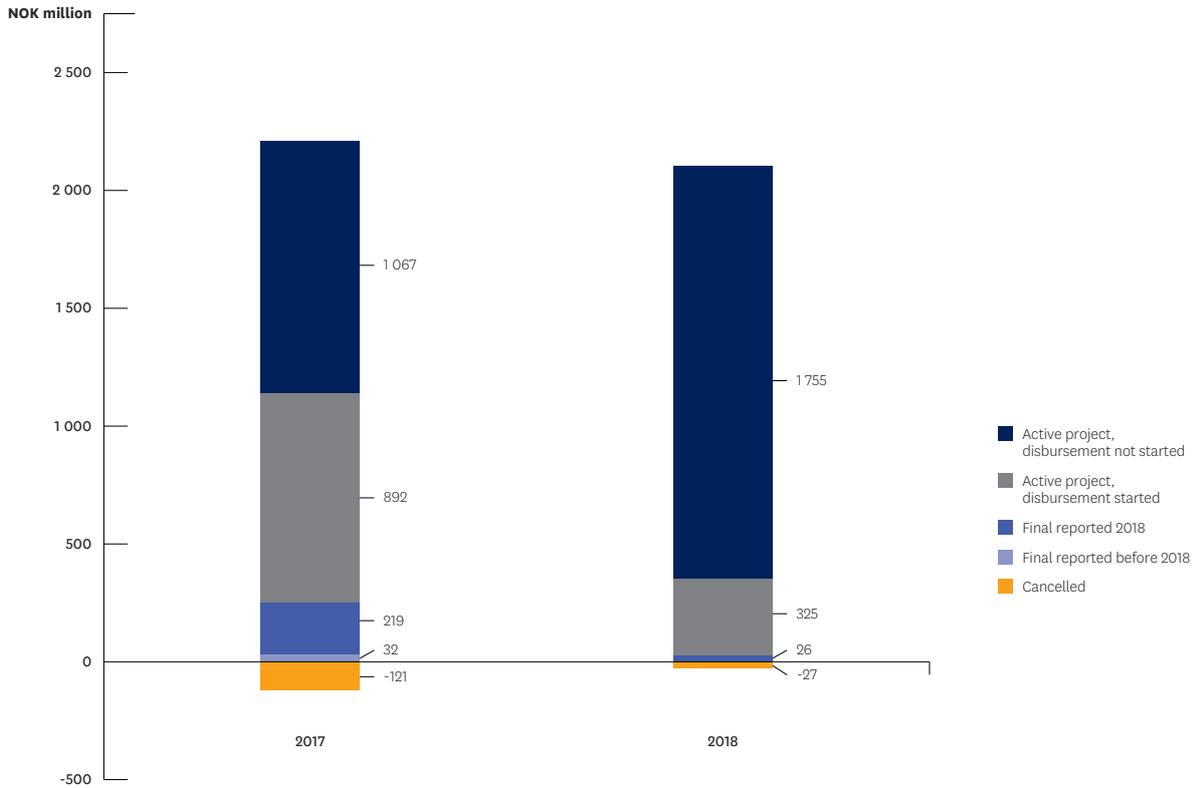
Status of project portfolio, measured in number of projects



**Figure 3.7:** The figure shows the percentage of final-reported, active and cancelled projects at the end of 2018, measured in number of projects. The figure also shows the percentage of projects where disbursement has started.

**Figure 3.8**

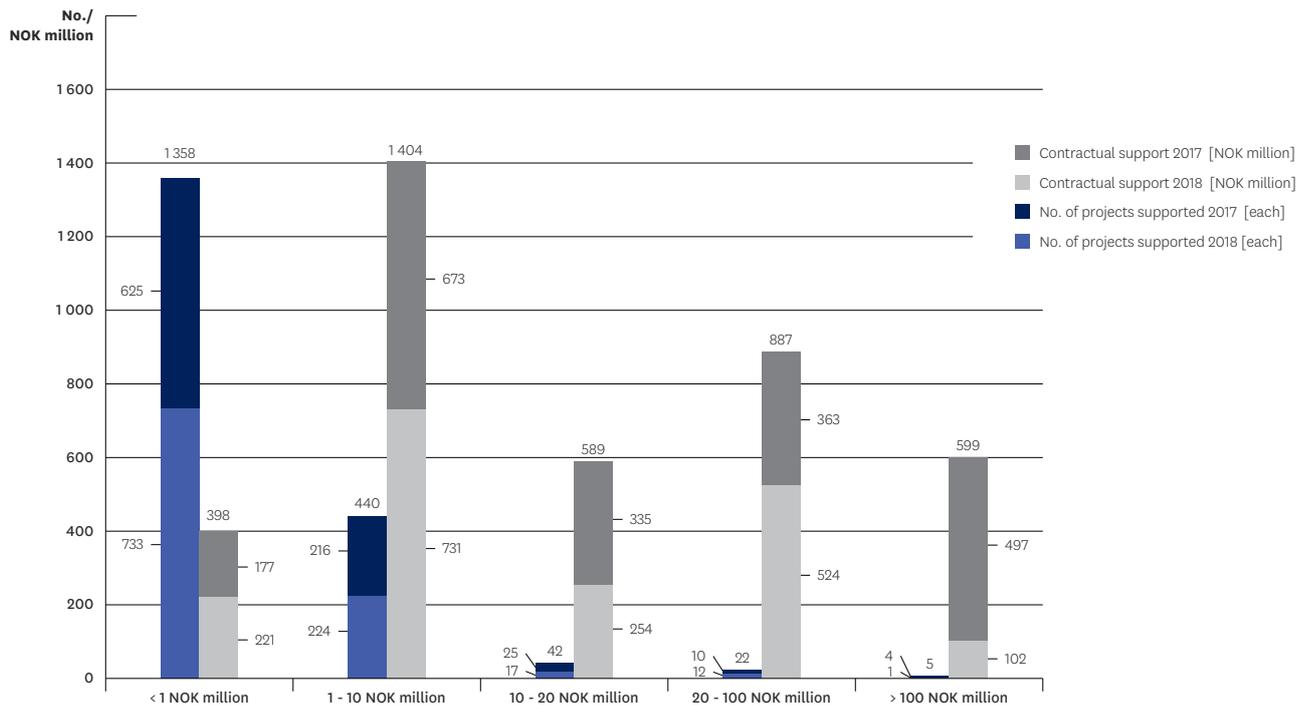
Status of project portfolio, measured in contractual support



**Figure 3.8:** The figure shows a status for projects approved in 2017 and 2018 at the end of the year, measured by awarded support. The figure shows the percentage of support granted that is related to final-reported, cancelled and active projects.

**Figure 3.9**

Projects 2017-2018 distributed by contractual support



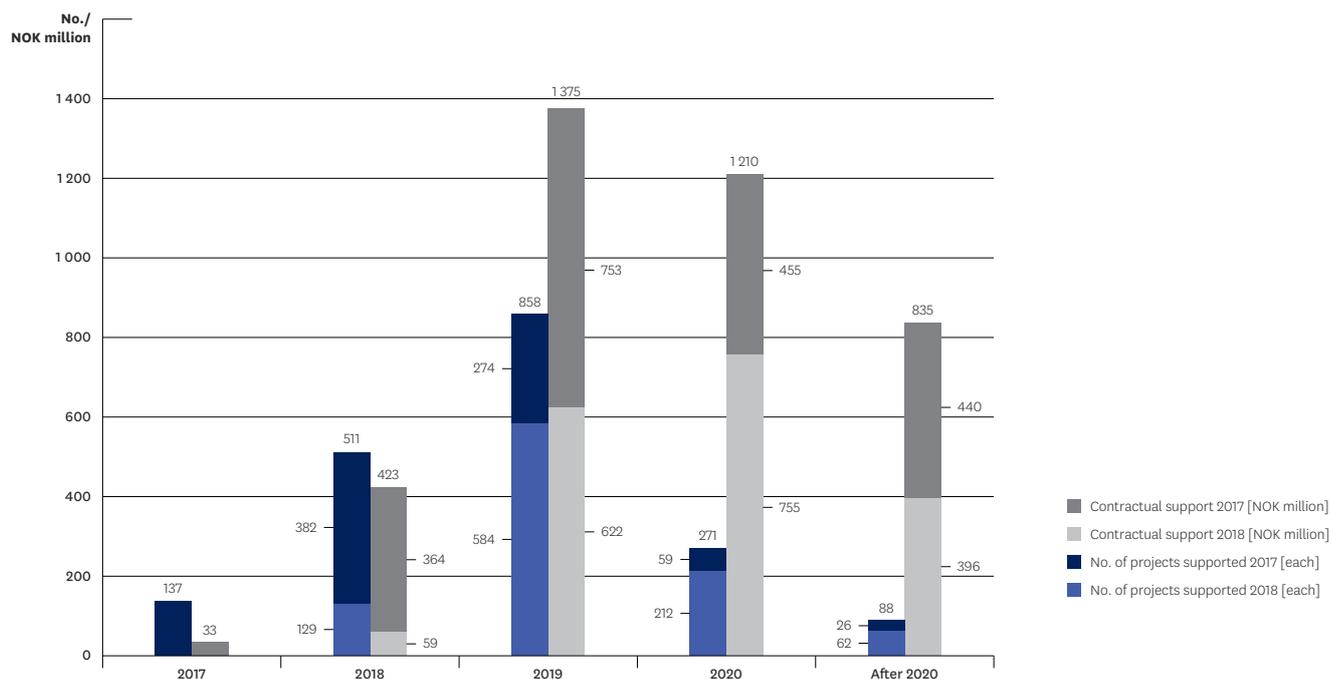
**Figure 3.9:** The figure shows a distribution of projects that were granted support in 2017 and 2018 grouped according to funding level. The Enova Subsidy is not included in this overview.

Figure 3.9 shows the distribution of the project portfolio by the size of approved support for 2017 and 2018. Most projects are awarded less than NOK 1 million, but these small projects make up a relatively small share of allocated funds. Looking at 2017 and 2018 overall, the 1,358 smallest projects constitute 73 per cent of the number of projects, and 10 per cent of allocated funds.

The 440 projects awarded support between NOK 1 and 10 million received a total of about NOK 1.4 billion in support, which amounts to 36 per cent of total allocated funds. About 4 per cent of the projects were granted more than NOK 10 million in support, and these amount to about 54 per cent of the total support.

**Figure 3.10**

Projects 2017-2018 distributed by contractual end date



**Figure 3.10:** The figure shows the distribution of projects entered into in 2017 and 2018 distributed by the projects' contractual end date. The Enova Subsidy is not included in this overview.

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

80 per cent of the projects are expected to be completed by the end of 2019. These projects make up 47 per cent of the total support. By the end of 2020, about 95 per cent of the supported projects are expected to be complete.

Nearly 22 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 5 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.

# Activities

## The Enova Subsidy

Enova has disbursed support to more residential projects in 2018 than in previous years. In total, almost 14,500 grants were disbursed last year, an increase of almost 80 per cent.

In 2020, use of fossil oil for heating will be prohibited. Through the Enova Subsidy, homeowners can receive support for removing oil burners and oil tanks while switching over to a heating solution based on renewable energy sources. The most popular single measure in 2018 was removal of oil stoves and oil tanks, with almost 2,700 grants. In addition, more than 2,500 homeowners received grants to remove their oil tank, combined with the purchase of a different, renewable heating source, thus ensuring that more than 5,200 oil tanks were removed in 2018. Many households carry out multiple measures at the same time.

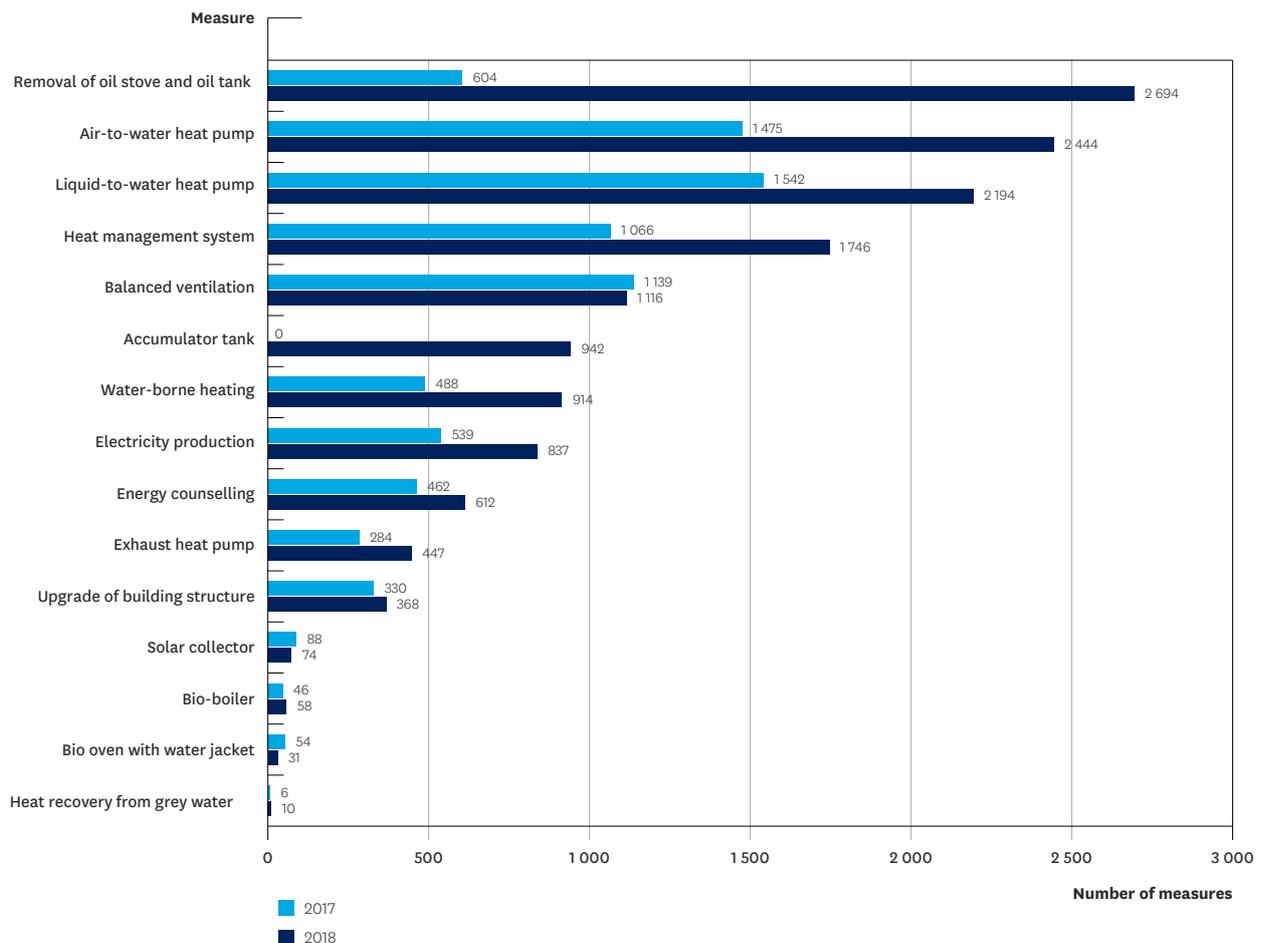
Air-to-water heat pumps and liquid-to-water heat pumps together accounted for more than 30 per cent of grants in 2018, followed by heat management systems (12 per cent) and retrofitting balanced ventilation (8 per cent).

Figure 3.11 compares the number of grants in 2018 with 2017. Installation of accumulator tanks is a new measure in 2018, and was utilised by 942 homeowners. Apart from that, the ranking of the measures is relatively similar for the two years, except the substantial increase in removal of oil stoves and oil tanks.

The most extensive and energy-conserving individual measure is upgrading the building structure. 368 such grants were disbursed in 2018, which is a 12 per cent increase from 2017.

**Figure 3.11**

Number 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 and 2018, distributed according to measure. 2,588 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 2018. The corresponding figure for 2017 was 1,044.

**Table 3.4**

Nationwide information services

Activity	Purpose of activity	2017	2018
<b>Ask Enova</b>		<b>58 609</b>	<b>79 805</b>
Private individuals	Nationwide information and consultation via telephone, e-mail and online chat to support the objectives of the Climate and Energy Fund.	43 573	64 754
Commercial players		15 036	15 051
<b>Enova.no (page views per day)</b>		<b>9 681</b>	<b>11 737</b>
Enova Subsidy (private market)	Information about Enova's services and consultation concerning energy and climate measures	3 754	6 807
Commercial share			4 930

**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 2017 and 2018.

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 almost 80,000 inquiries in 2018. This is an increase of about 35 per cent compared with the previous year. Table 3.4 shows that this increase is in inquiries from private

individuals, while the number of inquiries from commercial players remains stable. Use of our website has increased as a result of a significant growth in traffic from the private market, while there is a decline in the number of page references to the commercial section between 2017 and 2018.

Enova handles the operation and development of the Energy Certification Programme and programme for energy assessment of technical facilities. This scheme aims to provide relevant and tailored information about energy standards and potential efficiency measures and to act as a tool for players in the construction sector.

## Performance indicator for climate

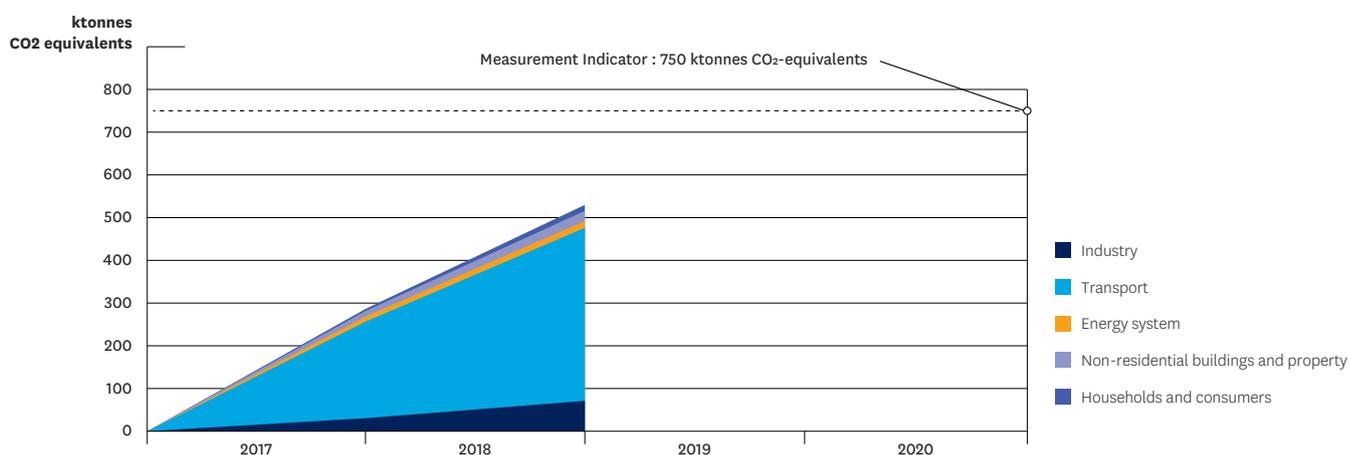
Enova must promote the reduction of greenhouse gas emissions that helps fulfil Norway's climate commitment for 2030. **The climate result** is the sum of changes in greenhouse gas emissions not subject to carbon credits as a result of various measures in the projects which Enova has supported. The calculation 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 through using internationally recognised GWP factors (Global Warming Potential).

In 2018, Enova supported projects that are expected to reduce annual emissions not subject to carbon credits by about 242,000 tonnes of CO<sub>2</sub> equivalents. Compared with the performance indicator of 750,000 tonnes of CO<sub>2</sub> equivalents, the climate result for 2018 is considered to be positive, and in isolation, this amounts to 32 per cent of the level for the agreement period.

**Figure 3.12**

Development in climate results 2017-2018



**Figure 3.12:** The figure shows expected climate results (ktonnes of CO<sub>2</sub> equiv.) in projects awarded support from the Climate and Energy Fund in 2017 and 2018. The results have been corrected for cancelled and final reported projects.

Greenhouse gas reductions totalling 179,000 tonnes of CO<sub>2</sub> equivalents come from the transport sector, distributed across about 160 individual projects. The majority of these results come from the maritime industry, including maritime offshore, onshore power and ferries. Energy and climate measures in ships and the introduction of energy management on large offshore vessels and tankers contribute a significant share of climate results in 2018. More than 25 per cent of the climate results on transport are linked to projects within new energy and climate technology.

A total of 144 projects from the industry are expected to

provide annual reductions of about 40,000 tonnes of CO<sub>2</sub> equivalents. 40 per cent of the climate results from the industry sector come from demonstration and full-scale projects within new energy and climate technology. These are relatively large projects, where they are testing new or changed production processes. About 15,000 tonnes of CO<sub>2</sub> reductions come from energy and climate measures in the industry, including onshore power for fish farming facilities and utilising bioresources.

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

**Table 3.5**  
Climate results

Sector	2017	2018	Total
	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.	ktonnes CO <sub>2</sub> equiv.
Industry	31	41	71
Transport	226	179	405
Energy system	12	3	15
Non-residential buildings and property	13	11	24
Households and consumers	5	9	14
<b>Total</b>	<b>287</b>	<b>242</b>	<b>529</b>

**Table 3.5:** The table shows the climate result (CO<sub>2</sub> equiv.) from projects in facilities not subject to carbon credits that were granted support in 2017 and 2018. The results are distributed according to 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 have been reduced by about 5 per cent from 561,000 to 532,000

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. In the table we can see that these updates have led to a marginal reduction in climate results.

**Table 3.6**  
Development in climate results 2017-2018

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	82	72	71
Transport	423	407	405
Energy system	16	15	15
Non-residential buildings and property	26	24	24
Households and consumers	14	14	14
<b>Total</b>	<b>561</b>	<b>532</b>	<b>529</b>

**Table 3.6:** The table shows the development in expected climate results (ktonnes 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 2018 portfolio, such measures are expected to contribute to a reduction of 56,000 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 quota 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 2018.

**Table 3.7**

Emission reductions that are 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		13	153	56
	Industry	12	144	55
	Energy system	1	9	1
Not subject to carbon credits		974	1 953	242
<b>Total</b>		<b>987</b>	<b>2 106</b>	<b>298</b>

**Table 3.7:** The table shows the number of projects in 2018 where Enova supported measures at facilities subject to carbon 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 (14,487 measures totalling 9.1 ktonnes CO<sub>2</sub> equiv.).

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

### 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 have a rights-based programme for support for publicly available charging infrastructure for electric cars. In 2018, 7 projects were supported with a total of NOK 187 million linked to infrastructure for municipal and county authority transport services. The majority of the support amount, NOK 111 million, went to projects related to infrastructure for ferries, while other support went to electrification of buses.

Support was also granted to 15 onshore power projects located along the coast from Aust-Agder County in the south to Troms County in the north. This support totalled NOK 131 million.

Activity in the market associated with establishing hydrogen infrastructure was not extensive in 2018; a total of 4 projects were granted support. Support was also provided for 29 projects associated with charging infrastructure for electric cars last year, distributed across 14 counties from Vest-Agder to Finnmark.

**Table 3.8**

Fuel infrastructure for emission-free ground and maritime transport 2017-2018

Programme	2018				2017-2018			
	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	15	131	46	12	40	284	149	40
Support for infrastructure for municipal and county authority transport services	7	187	66	18	12	322	125	33
Hydrogen infrastructure	4	24	-	-	7	55	-	-
Support for charging infrastructure for electric cars	29	8	-	-	60	18	-	-

**Table 3.8:** The table shows the number of projects that were granted support within Enova's programmes aimed at emission-free ground and maritime transport in 2017-2018. 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.

# Performance indicator for innovation

Enova shall promote increased innovation within energy and climate technology adapted to the adjustment to the low-emission society. **Innovation results** are recorded from projects that contribute to increased innovation within energy and climate technology, and these results are measured in triggered capital in NOK. 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

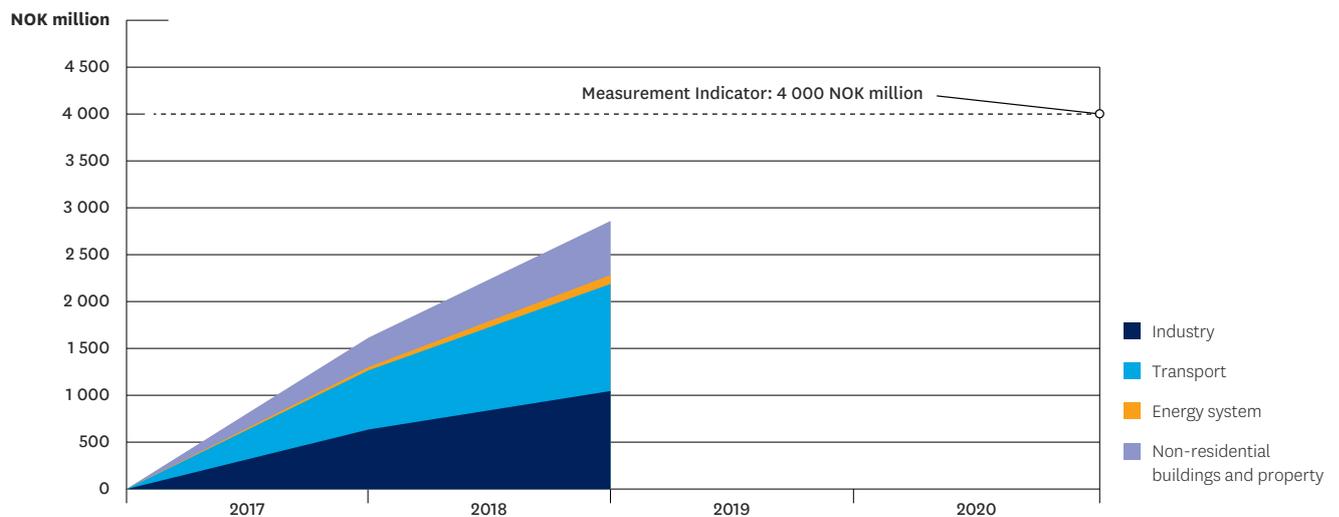
capital. The support will contribute to triggering projects and investment in new solutions and technology development.

Enova invested around NOK 520 million in projects within new energy and climate technology in 2018. It is our experience that there is a willingness in the market to innovate and develop technology, but that the response to the programmes varies between sectors. The support is expected to trigger about NOK 1.2 billion in the form of private innovation capital.

Compared to the performance indicator of NOK 4 billion during the agreement term, the results in 2018 are good and constitute 31 per cent of the level for the period.

**Figure 3.13**

Development in triggered innovation capital 2017-2018



**Figure 3.13:** The figure shows expected triggered innovation capital (NOK million) in projects within new energy and climate technology that were granted support from the Climate and Energy Fund in 2017 and 2018.

Projects within transport triggered the most innovation capital in 2018. These constitute about 40 per cent of the innovation result, followed by industry projects at just below 35 per cent.

Non-residential buildings and property projects account for about 20 per cent of the result.

**Table 3.9**

## Triggered innovation capital

Sector	2017	2018	Total
	NOK million	NOK million	NOK million
Industry	638	412	1 050
Transport	634	460	1 094
Energy system	35	60	96
Non-residential buildings and property	313	264	577
Households and consumers	-	-	-
<b>Total</b>	<b>1 620</b>	<b>1 197</b>	<b>2 817</b>

**Table 3.9:** The table shows expected triggered innovation capital (NOK million) in projects that were granted support in 2017-2018, distributed by sector. The results have been corrected for cancelled and final-reported projects as of 2018.

Table 3.10 shows that cancellations within transport have somewhat reduced the expected triggered innovation capital. In total, final reporting of finished projects only has

a marginal effect, but we can see that transport provides a positive contribution, while industry provides a negative contribution.

**Table 3.10**

## Development in triggered innovation capital 2017-2018

Sector	Original result	Result corrected for cancellations	Result corrected for final reported results
	NOK million	NOK million	NOK million
Industry	1 078	1 078	1 050
Transport	1 132	1 079	1 094
Energy system	95	95	96
Non-residential buildings and property	575	574	577
Households and consumers	-	-	-
<b>Total</b>	<b>2 881</b>	<b>2 826</b>	<b>2 817</b>

**Table 3.10:** 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. In 2018, the full-scale projects within industry trigger the largest share of innovation capital. These are challenging projects, requiring a lot of effort on the part of the players to implement and they depend on support for realization. Overall, the 17 technology projects within industry represent a diverse range of industrial activity.

Within transport, maritime industry is the primary contributor to innovation results. The introduction of new technology

for buildings and areas accounts for the majority of results within non-residential buildings and property. Projects associated with buildings and plants and facilities constitute 76 of the 106 supported projects. More than 50 per cent (37 projects) of these concern support for concept assessments for buildings. These are projects that trigger a very small percentage of private innovation capital, but are important in order to develop future projects. Through the concept assessment service, Enova enables the players to conduct more comprehensive planning before a final investment decision is made for innovative solutions.

**Table 3.11**

Support for new energy and climate technology

Sector	2018		2017-2018	
	No. of projects supported	Contractual support	No. of projects supported	Contractual support
		NOK million		NOK million
<b>Industri</b>	<b>17</b>	<b>256</b>	<b>41</b>	<b>531</b>
Pilot testing of new energy and climate technology in industry	4	8	11	176
Demonstration of new energy and climate technology	2	28	3	28
Full-scale innovative energy and climate technology	8	197	19	281
Pre-project support for new energy and climate technology in the industry	3	23	8	46
<b>Transport</b>	<b>5</b>	<b>53</b>	<b>19</b>	<b>425</b>
Pilot-testing of new energy and climate technology	1	8	1	8
Full-scale innovative energy and climate technology	4	46	18	417
<b>Energy system</b>	<b>8</b>	<b>45</b>	<b>9</b>	<b>58</b>
Demonstration of new energy and climate technology	2	7	2	7
Full-scale innovative energy and climate technology	6	39	7	51
<b>Non-residential buildings and property</b>	<b>76</b>	<b>165</b>	<b>144</b>	<b>385</b>
Introduction of new technology in buildings and areas	29	102	29	102
Commercial testing	7	12	7	12
Support for energy-efficient new buildings	3	26	27	217
Support for new technology for the future's buildings	0	-	4	3
Support for concept assessment buildings	37	25	77	51
<b>Total</b>	<b>106</b>	<b>519</b>	<b>213</b>	<b>1 398</b>

**Table 3.11:** The table shows the number of projects and contractual support (NOK million) within new energy and climate technology during the 2017-2018 period, distributed by sector. The figures have been corrected for cancelled and final-reported projects as of 2018.

Table 3.12 shows a few examples of projects within new energy and climate technology that Enova supported in 2018.

More information about this category of projects can be found on Enova's website [enova.no](http://enova.no).

**Table 3.12**

Examples of projects within new energy and climate technology 2018

Project owner / Project	Sector / Programme	Contractual support (NOK million)	Description/innovation
Rockwool: Conversion to green energy	Industry / Full-scale innovative energy and climate technology	102	<ul style="list-style-type: none"> <li>• Investering elektrisk smelteovn for produksjon av steinull (Rockwool).</li> <li>• Primærformål er å redusere klimagasser fra egen produksjon ved overgang til elektrisitet fra kull/koks.</li> <li>• Et sekundært formål er resirkulering av avfall fra byggeplass og eget avfall.</li> </ul> <p>Innovasjon: Forbedret isoleringsmateriale på innsiden av smelteovnen, Smelterenue/homogeniserings kanal mellom ovn og spinner, Submerged Arc Furnace (SAF) basert på el-smelte for basalt med økt effektivitet og økt resirkulering</p>
Ruter AS: Hydrogen buses in regional operation	Transport / Full-scale innovative energy and climate technology	38	<ul style="list-style-type: none"> <li>• Uttesting av 10 hydrogenbusser i operativ drift på regionruter i Akershus som en del av målet om fossilfri kollektivtransport i løpet av 2020</li> <li>• Ruter deltar i EU-prosjektet JIVE 2 hvor det totalt skal anskaffes ca. 150 hydrogenbusser for bruk i europeiske byer.</li> </ul> <p>Innovasjon: Kostnadsreduksjon for hydrogenbusser, tilgjengelighet av hydrogendrevne regionbusser i det norske markedet og utvikling av verdikjeder på flere nivåer.</p>
Ministry of Justice and Public Security: Geothermal energy wells Police Emergency Response Centre (PNB)	Non-residential buildings and property / Introducing new technology for buildings and areas	15	<ul style="list-style-type: none"> <li>• Prosjekt gjelder boring av seks dype borehull ned til 1 500 meter. Det vil bli benyttet sirkulasjonspumper for å hente opp termisk energi fra borehullene.</li> <li>• Bruk av borehull til denne dybde er i svært liten grad benyttet i Norge tidligere (2. implementering i Norge)</li> </ul> <p>Innovasjon: Effektreduksjon: Geotermiske brønner bidrar til at effekt behovet reduseres Fornybar oppvarming: Fornybar oppvarming uten behov for VP Kostnadsreduksjon: Prosjekt bidrar til at kostnadene for neste implementasjon synker Virkningsgrad på 20. Hvert borehull gir 100-150 kW og det trengs kun pumpe på 3 kW per borehull.</p>
Ringeriks-Kraft Nett AS: Full-scale demonstration of a system-oriented and optimally designed technological solution for distribution grid	Energy system / Full-scale innovative energy and climate technology	8	<ul style="list-style-type: none"> <li>• Prosjektet er et samarbeidsprosjekt om innføring og utnyttelse av ny teknologi for å skape økt fleksibilitet og økt fremtidig forsyningsikkerhet i distribusjonsnettet.</li> <li>• Et viktig formål er å realisere gevinster gjennom samspill mellom konvensjonell og ny teknologi for å ivareta fremtidige behov knyttet til økt introduksjon av distribuerte energiresurser, fleksibilitet, elektrifisering av transportsektoren og digitalisering av arbeidsprosesser.</li> </ul> <p>Innovasjon: Benytte AMS-data til effektreduksjon Frigjøring av effekt til elektrifisering av transport Redusert effektbelastning Systeminnovasjon - gjennom å utnytte potensialer for samspill mellom konvensjonell og ny teknologi Utnyttelse av termisk lagring i varmtvannsberedere</p>

**Table 3.12:** The table shows examples of projects within new energy and climate technology approved in 2018. For a more detailed overview of these projects and other climate and energy technology projects approved in 2018, 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 the security of good delivery quality and sufficient capacity 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.

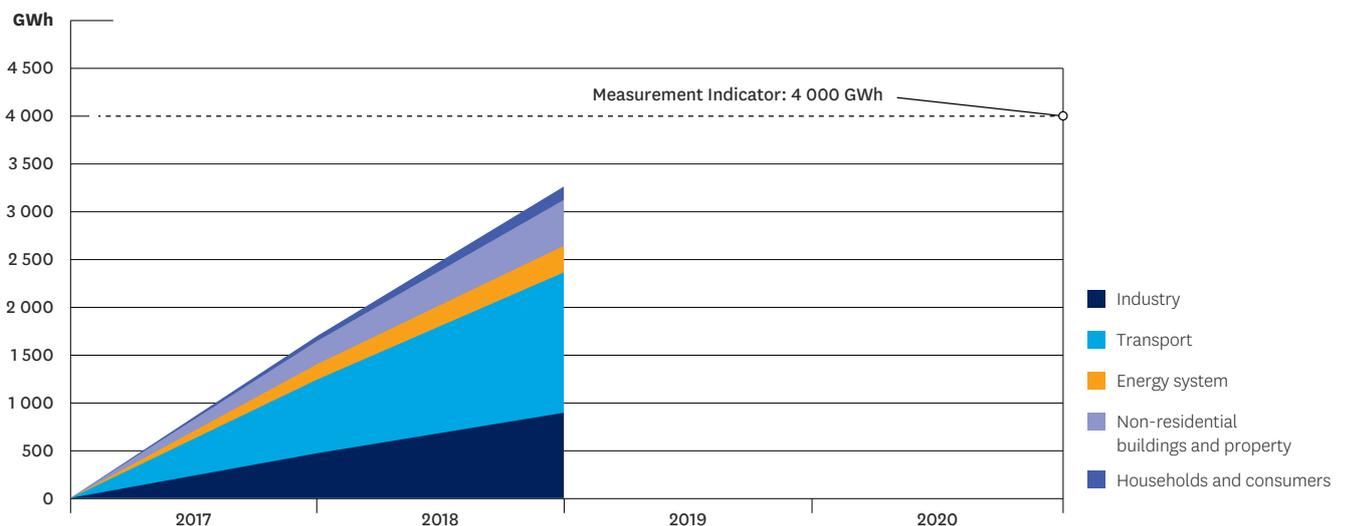
Improvement of the long-term security of supply is measured in the form of energy volume (kWh), while we measure improvement of the short-term security of supply in the form of reduced demand in the power grid (kW). In 2018, Enova supported projects that are expected to yield 1.6 TWh in energy results and 123 MW in reduced peak demand results.

## Energy results

The energy result of 1.6 TWh is considered good in relation to the performance indicator of 4 TWh over the course of the agreement term, and amounts to 39 per cent of the level for the term as a whole.

**Figure 3.14**

Development in energy results 2017-2018



**Figure 3.14:** The figure shows expected energy results (GWh) in projects that received support from the Climate and Energy Fund in 2017 and 2018.

The greatest energy results, 45 per cent, came from the transport sector. Of a total of 203 transport projects, more than 40 per cent are associated with energy management, and these make up about 56 per cent of the energy result from the transport sector. Energy management is about ensuring that the enterprise is aware of its energy consumption and reviews its activities

to identify which measures can be implemented to optimise energy consumption, operating costs and reduce emissions in the enterprise. The knowledge that the company gains through the mapping provides a good basis for assessing further energy and climate measures in the company.

Industry accounts for nearly 30 per cent of the energy results. Of the 191 industry projects, energy management accounts for more than one-half of the projects, but only about 20 per cent of the energy result from the sector. The majority of the energy result comes from energy and climate measures in industry and construction. This is a support programme that targets the entire scope of the sector and features varied projects, and a total of 20 projects are contributing more than 1 GWh each. However, the largest individual projects are technology projects.

Energy results within non-residential buildings and property account for 15 per cent in 2018, and the majority of the results from these 556 projects come from measures in existing buildings.

The energy system contributes about 8 per cent of the energy results. These primarily come from a few relatively large district heating projects, and a high number of heating plants.

Energy results from households and consumers come from implemented measures associated with the Enova Subsidy.

**Table 3.13**  
Energy results

Sektor	2017	2018	Total
	GWh	GWh	GWh
Industry	468	423	891
Transport	771	696	1 467
Energy system	161	117	278
Non-residential buildings and property	242	237	479
Households and consumers	52	87	140
<b>Total</b>	<b>1 693</b>	<b>1 561</b>	<b>3 255</b>

**Table 3.13:** The table shows expected energy results (GWh) in projects that received support in 2017-2018, distributed by sector. The results have been corrected for cancelled and final-reported projects as of 2018.

The expected energy results have been reduced as a result of cancellations and final reporting. Table 3.14 shows that cancellations have reduced the energy results by about 5 per cent on

industry, transport and non-residential buildings and property, while mainly industry projects have further reduced energy results in connection with final reporting.

**Table 3.14**  
Development in energy results 2017-2018

Sektor	Original result	Result corrected for cancellations	Result corrected for final reported results
	GWh	GWh	GWh
Industry	989	931	891
Transport	1 551	1 475	1 467
Energy system	278	278	278
Non-residential buildings and property	507	484	479
Households and consumers	140	140	140
<b>Total</b>	<b>3 466</b>	<b>3 307</b>	<b>3 255</b>

**Table 3.14:** 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.

The conversion projects are projects where the energy carrier is changed from electricity or fossil energy carriers to renewable energy carriers based on, for example, bioenergy. 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 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.

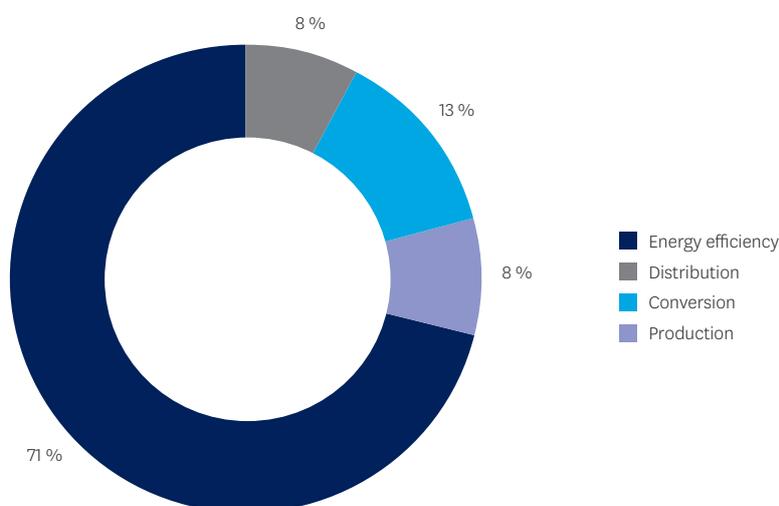
Energy efficiency accounted for 70 per cent of the energy result in 2018, and has been the most important energy result category for several years. Table 3.15 shows how different types of energy results are distributed for each sector, while Figure 3.15 shows overall distribution of project categories for 2017 and 2018.

**Table 3.15**  
2018 energy result distributed by project category

Sector	Energy efficiency measures	Production	Distribution	Conversion
	GWh	GWh	GWh	GWh
Industry	304	58	-	55
Transport	613	19	-	63
Energy system	4	5	110	4
Non-residential buildings and property	152	10	-	78
Households and consumers	16	4	-	68
<b>Total</b>	<b>1 090</b>	<b>96</b>	<b>110</b>	<b>267</b>

**Table 3.15:** The table shows energy results (GWh) in 2018 distributed by project category and sector. The figures have been corrected for cancelled projects.

**Figure 3.15**  
Energy result distributed by project category 2017-2018



**Figure 3.15:** The figure shows the distribution of expected energy results (GWh) in 2017 and 2018 distributed by project category.

Table 3.16 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 473 GWh. In 2018, waste incineration accounted for the largest share of energy deliveries in 2018, with 182 GWh.

The next energy carriers are bioenergy, heat pumps and electricity. The contributions from the other energy carriers were modest in 2018. The energy delivery is more evenly distributed across energy carriers in 2018 than in 2017, when the delivery from waste incineration was relatively low.

**Table 3.16**

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

Energy carrier	Energy result
	GWh
Waste	182
Bioenergy	141
<i>Chips</i>	34
<i>Pellets and briquettes</i>	41
<i>Other bio</i>	41
<i>Biomass</i>	25
Heat pump	78
Electricity	63
District heating	4
Waste heat	4
Solar	1
Wind	0
<b>Total</b>	<b>473</b>

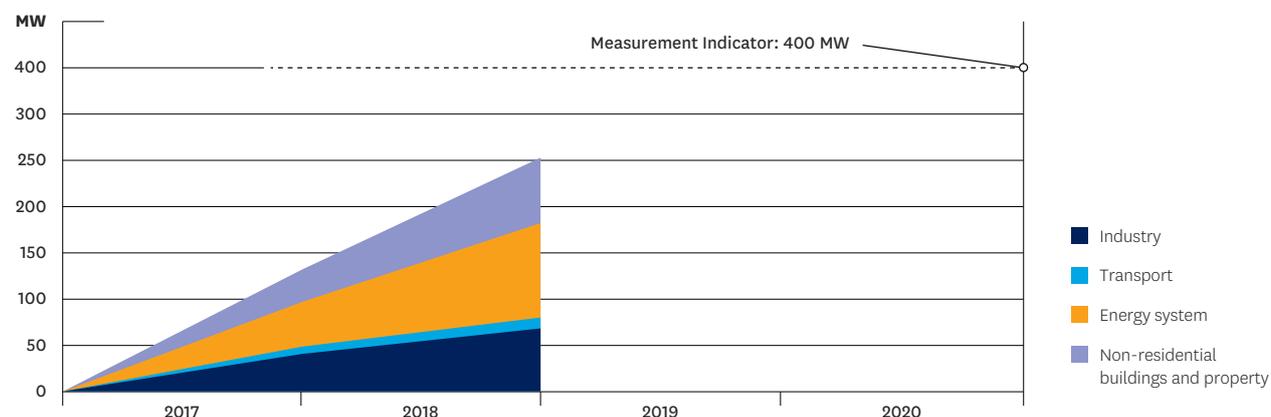
**Table 3.16:** The figure shows the energy result within production, distribution and conversion distributed by energy carrier.

## Reduced peak demand results

The reduced peak demand result of 123 MW is considered good in relation to the performance indicator of 400 MW, and accounts for 31 per cent of the level for the agreement term.

**Figure 3.16**

Development in reduced peak demand results 2017-2018



**Figure 3.16:** The figure shows expected energy results (MW) in projects that received support from the Climate and Energy Fund in 2017 and 2018. The results have been corrected for cancelled and final reported projects.

Table 3.17 shows that the largest reduced peak demand results for 2018 come from projects associated with the energy system, followed by non-residential buildings and property, as well as industry.

A total of 395 projects have reduced peak demand results, and 26 district heating projects account for 40 per cent of this. Within non-residential buildings and property and industry,

reduced peak demand results per project were relatively low, but the large number of projects means that the sectors nevertheless contribute a considerable share of the overall reduced peak demand results.

Table 3.18 shows that the overall reduced peak demand results for 2017 and 2018 are relatively stable, with minor adjustments for cancellations and final reporting.

**Table 3.17**

Reduced peak demand results

Sector	2017	2018	Total
	MW	MW	MW
Industry	41	28	69
Transport	8	4	12
Energy system	49	55	104
Non-residential buildings and property	35	36	72
Households and consumers	0	0	0
<b>Total energy results</b>	<b>133</b>	<b>123</b>	<b>256</b>

**Table 3.17:** The table shows expected reduced peak demand results (MW) for projects that received support in 2017 and 2018, distributed by sector.

**Table 3.18**

Development in reduced peak demand results 2017-2018

Sector	Original result	Result corrected for cancellations	Result corrected for final reported results
	MW	MW	MW
Industry	74	73	69
Transport	11	11	12
Energy system	101	101	104
Non-residential buildings and property	75	74	72
Households and consumers	-	-	-
<b>Total</b>	<b>261</b>	<b>258</b>	<b>256</b>

**Table 3.18:** 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 3.19 shows the allocation of funds from the Energy Fund and total energy results from the period 2012-2016, updated at the end of 2018, 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 use in new projects. NOK 641 million was released in 2018 from cancelled and final reported

projects. These projects entail that the expected energy result for the 2012-2016 period has been reduced by 294 GWh since the status reporting at year-end 2017.

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

**Table 3.19**

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

	2012		2013		2014		2015		2016		Totalt	
	GWh	NOK million	GWh	NOK million	GWh	NOK million	GWh	NOK million	GWh	NOK million	GWh	NOK million
Renewable heating	224	223	342	379	325	333	156	208	162	202	1 209	1 346
Renewable power	3	5	6	13	0	1	3	19	7	12	19	50
Industry	554	484	399	263	1 026	2 064	676	897	2 549	619	5 205	4 326
Transport							166	249	644	799	809	1 048
Non-industrial plants and facilities	5	3	12	34	31	30	62	66	22	20	133	154
Non-residential building	404	438	375	557	273	351	319	424	299	430	1 669	2 201
Residential buildings	24	77	26	104	18	51	91	149	41	119	201	501
International projects	-	3	-	6	-	2	-	3	-	3	-	17
Consultation and communication	-	56	-	65	-	55	-	53	-	62	-	290
External analyses and development measures	-	32	-	28	-	32	-	23	-	36	-	150
Administration		98		110		129		148		151		635
<b>Total</b>	<b>1 214</b>	<b>1 419</b>	<b>1 159</b>	<b>1 559</b>	<b>1 673</b>	<b>3 047</b>	<b>1 473</b>	<b>2 239</b>	<b>3 725</b>	<b>2 454</b>	<b>9 244</b>	<b>10 719</b>
<b>Of which:</b>												
Ordinary energy projects	1 207	1 184	1 105	1 208	1 537	1 136	1 107	984	3 516	1 708	8 472	6 221
Projects within new technology	7	45	54	142	136	1 694	366	1 029	209	494	772	3 405

**Table 3.19:** 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 2018. Projects within the programmes for new energy and climate technology are distributed in the respective markets. From 2015, the Support for biogas and biofuel programme is reported under the Transport market.

Table 3.20 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 just over 10 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 exemption is for industry, where the energy results are improved upon final reporting and subsequent measurement of realised results.

Table 3.20

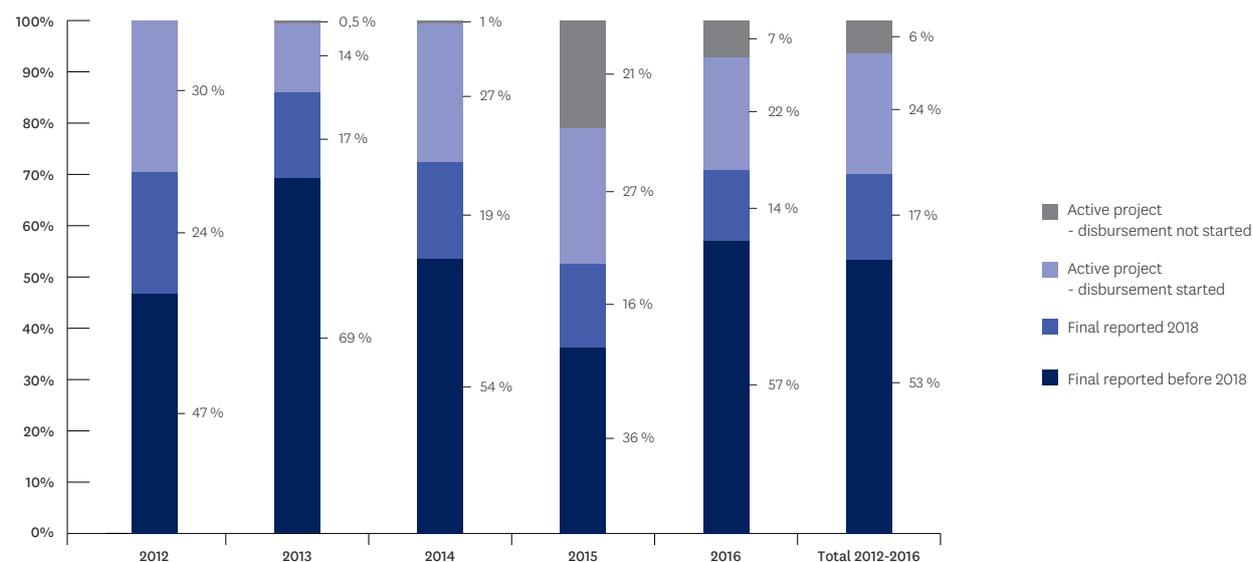
Energy results 2012-2016 distributed by markets

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	1 195	1 209	1 212
Renewable power	56	20	19	19
Industry	5 231	4 876	5 205	5 184
Transport	971	821	809	809
Non-industrial plants and facilities	159	135	133	133
Non-residential buildings	2 148	1 788	1 669	1 654
Residential buildings	345	206	201	201
<b>Total</b>	<b>10 363</b>	<b>9 040</b>	<b>9 244</b>	<b>9 212</b>

**Table 3.20:** 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 2018 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 2018, 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 see that 70 per cent of the energy result from the period was final-reported as of the end of 2018. The ratio of final-reported projects generally increases with age; this is shown for the 2013-2016 period. As regards the 2012 projects, more than 98 per cent of the projects were final-reported, but the last 2 per cent accounts for around 30 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 6 per cent of the result is

associated with projects where disbursement has yet to start. The 2015 projects stand out here, where more than 1/5 of the result is associated with projects where disbursement has not started. Nevertheless, this concerns a small number of projects (5 per cent).

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 supervision ensures that the funds will not be unnecessarily stuck in projects with no progress.

In 2018, about 1.5 TWh has been final-reported from projects that were approved in 2012-2016.



# PART IV

# MANAGEMENT AND CONTROL IN THE ORGANISATION

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# Management and control in the organisation

Enova manages the public funds on behalf of the Norwegian State. 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. Enova shall administer its public funds efficiently, thus ensuring that society achieves the greatest possible result per NOK.

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 objective of the support outweighs the negative effect on competition. In order to achieve a shared objective for efficient 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.

The state aid rules are an important framework condition for Enova, but even though the regulations frame the use of policy instruments, Enova has considerable latitude through programmes established within the framework of the regulations and have the ESA seal of approval. All our programmes are described in more detail at [enova.no/esa](http://enova.no/esa).

## Management by objectives

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 organisation.

Enova conducts evaluations of 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 result.

## Management by missions and market change goals

No-one can accurately describe the low-emission society in detail 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 strategic decisions toward 2050, we have prioritised six thematic efforts, missions, that will play a decisive role in achieving this transition. Our missions say something about Enova's strategic direction within the framework of our assignments and the management agreement with the MCE.

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 just one 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.

The market change goals must be followed up using indicators that tell us how we are developing toward the objective. By systematically following up progress, and developing risk to attain 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 developing the organisation.

## Risk

Good risk management is a precondition in order for Enova to achieve its goals. Our strategy for risk management and internal control underpins the enterprise's general attitudes to this, and adequately ensures that risk is kept within a prudent framework.

Risk management and internal control is an integrated part of

Enova's governance. 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. A general risk assessment is sent to the MCE each year in accordance with the requirements in the assignment letter.

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.

Society and Enova are continually changing. The risk of sensitive business information about projects we support going astray has become a major issue 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 players must be able to trust Enova to handle business-critical information in a prudent manner. So far, we have handled this in a satisfactory manner and measures were implemented in 2018 to maintain 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 competence 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. A number of hiring processes in 2018 have allowed us to strengthen our team with relevant expertise.

### 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 project portfolio, awards via the Climate and Energy Fund and operation of the company. There are built-in controls in systems and routines for project portfolio management and operations in general, and we have a dedicated resource to safeguard the general responsibility for risk management and internal control in the company. As part of Enova's internal decision-making structure, the enterprise has an appropriations committee (AC) that is independent of the line organisation. This committee makes decisions on economic transactions in the Climate and Energy Fund in accordance with delegated authorisations and consists of employees that have not participated in portfolio management. Enova also conducts regular external quality assurances of basic figures and reporting of results in relation to the goals.

Values and ethical guidelines are important parts of Enova's corporate culture. Over the past year, we updated and relaunched our ethical guidelines, and in this connection have carried out a number of activities linked to familiarity with the guidelines and reflected on various ethical dilemmas.

The EU's General Data Protection Regulation (GDPR) became Norwegian law in 2018. This entails new rules for data privacy and the new regulations will include new requirements for enterprises and new rights for individuals. Enova has established roles and routines to ensure that the enterprise satisfies the requirements in the new rules.

Agreed-upon verification assignments are carried out by an external auditor when necessary for objective and independent assessment of the company. What becomes subject to the verification is based on the systematic risk assessment we conduct during the year. The results are included in our work on continuous development and efficiency improvement. Agreed audit actions of the processes associated with public procurement were carried out in 2018. The result of the review shows that Enova is well-equipped to avoid procurements in violation of statutes and regulations. Deliberate and systematic work is under way in this regard, and we appear to have sufficient access to both internal and external expertise. The organisation and systems are sensibly designed in relation to the enterprise's size and complexity. Enova emphasises learning and uses third-party assessments for further development.

In 2018, 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 2018. Based on the results from external verifications 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.

## Support system and tools

Enova processes and follows up an ever-growing number of projects, while society is becoming increasingly digitalised. This increases the need to focus on data security, which requires sound control over IT systems, and increasing the awareness of employees in the company. For example, Enova is participating in National Information Security Month, where the employees participate in e-learning courses in information security.

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

Enova is the process of carrying out a project for comprehensive enterprise management and organisation development. In 2018, we procured and utilised new digital solutions for internal collaboration. We have also utilised a new system for analysis and sharing of data.

Enova depends on agile and effective collaboration with the market. This sets ever increasing demands for our digital solutions, which is why we are now in the process of building the business platform of tomorrow. Enova's new, digital business platform will help ensure our ability to develop policy instruments that can contribute to lasting market change. The quantitative gains will primarily be due to releasing resources in the organisation as the result of increasingly efficient management and follow-up of the project portfolio.

# 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 coming generations to make good energy and climate choices.

**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

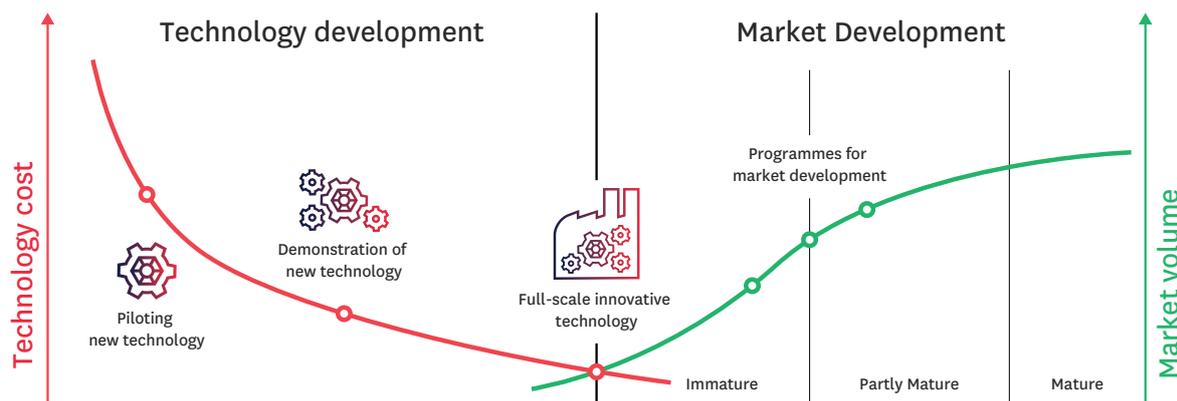
information to players. In small projects, we provide advice through Ask Enova, and through advice and guidance online. In large projects, we work closely with players over time, allowing the projects to benefit from the expertise and experience of Enova employees, which they have gained by managing a portfolio comprising several thousand projects.

## 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 initial testing or the final obstacle before the technology is taken up on the market and establishes itself as a standard.

Figure 4.1

Technology development and market development



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.

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 affect them to varying degrees. In order for the market to choose to invest in sustainable solutions, it must see a long-term valuecreation potential in replacing fossil alternatives with renewable 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.

## 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 this section we will describe a few key case processing methods related to applications and project follow-up.

## Evaluation of immature technologies and innovation projects

*The Technology Readiness Level (TRL) and Commercial Readiness Index (CRI)* 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 on the market. Although various technologies could be verified and ready for commercialisation, 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 correlation between TRL and CRI is shown in the figure above.

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. The figure below shows examples of scoring project applications.

**Figure 4.2**  
Technology maturity

		<b>CRI</b>	
		6	Market-based and "bankable"
		5	Market competition, extensive dissemination
		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		

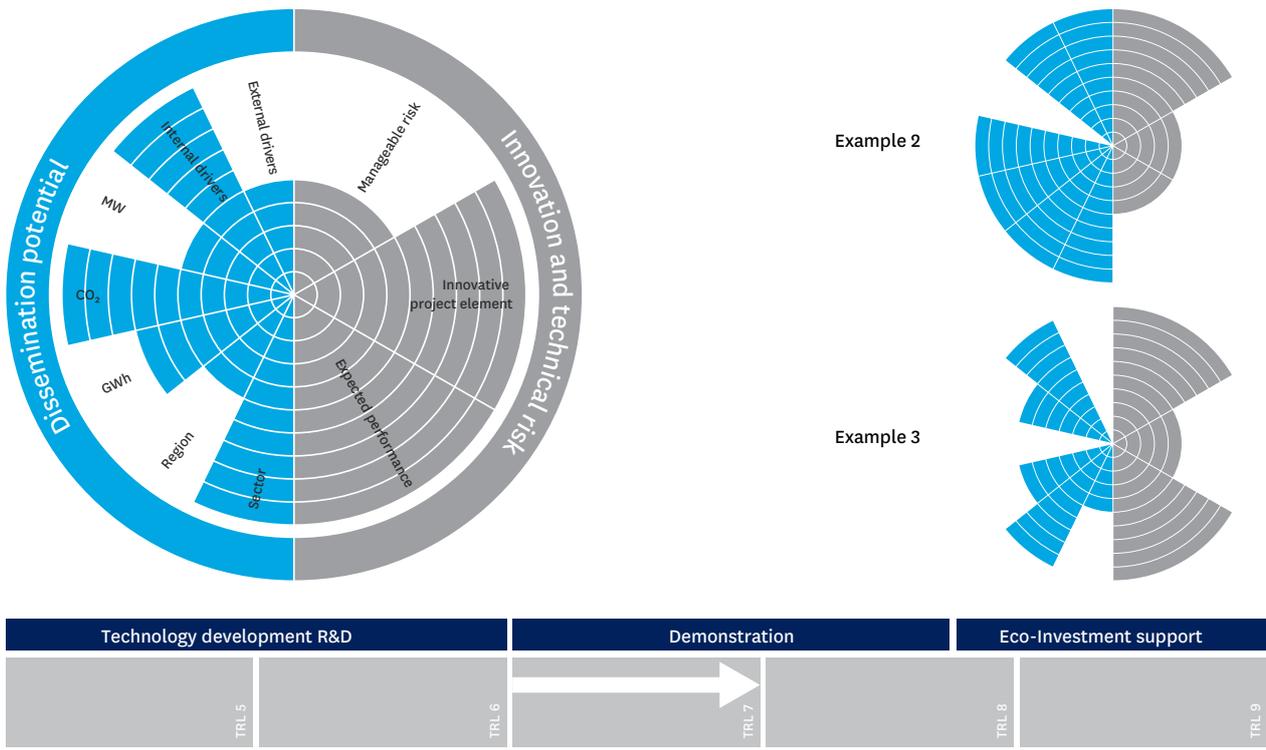
Source: NASA, ARENA.

<sup>2</sup> Developed by NASA - National Aeronautics and Space Administration in the US.

<sup>3</sup> Developed by ARENA - Australian Renewable Energy Agency.

**Figure 4.3**

Mapping of potential and risk



**Figur 4.3:** The figure shows examples of scoring project applications. 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 CO2 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 must report energy results at three stages; upon entering into the contract, upon final reporting to Enova and generally three years after the final report is submitted. At 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 supported 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 be confirmed by an auditor and certified by the person responsible for finances in the subsidy recipient's organisation.

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.

**Reasonable return**

In order to ensure the support is sufficient for the projects to be completed, the project owner must consider the benefits of the project to be greater 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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63	- Non-residential buildings and property
64	- Households and consumers



## **Necessary changes**

In October 2018, the Intergovernmental Panel on Climate Change issued a report reiterating the need to ramp up efforts to reduce global greenhouse gas emissions. The report showed that both 1.5 and 2 degrees of global warming will result in a considerably increased risk of serious consequences for ecosystems, people and communities around the world. The world set a new emission record the same year, and the UN Climate Change Conference in Katowice in December showed that it is challenging to bring the world together to stimulate the adequate drive and pace of the changes toward zero emissions. At the same time, more frequent and more dramatic extreme weather, rising sea levels and less ice in the Arctic all indicate that the climate change the world is attempting to curtail, has already started.

### **The international community is increasing its energy demand and must cut emissions at the same time**

The world is not emitting greenhouse gases just for fun. It takes a lot of energy to run a society. 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. Global population growth and economic growth will continue to drive demand for goods and services that require energy, and even though renewable power generation is growing, the percentage of renewables in the world's overall energy mix is still very modest. As economic growth leads to increased energy consumption, and as energy generation and consumption are, thus far, associated with considerable greenhouse gas emissions, the emissions will continue to grow unless additional measures are carried out.

In order to spare the Earth from the worst consequences of climate change, the emissions of greenhouse gases must be reduced toward or below zero during the course of just a couple of generations. This is not impossible, but requires a transition the likes of which the world has never seen. Such a transition will be made up of large and small changes, how 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. 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.

### **Lasting market change**

However, 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 sufficient demand. 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 accelerate 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.

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. Greenhouse gas emissions must come down, and both energy consumption and demand consumption must be more efficient. On this basis, Enova has designated the following six necessary changes – six missions – for Norway on the road toward a low emission society:

- The market chooses zero-emission industry
- The market chooses zero-emission vessels
- The market chooses zero-emission vehicles
- The market chooses to use energy and resources efficiently
- The market chooses to utilise the flexibility in the energy system
- The market chooses to utilise renewable resources

These necessary components of a low-emission society are also particularly important in order to maintain and strengthen value creation in Norway. These are also six areas where Enova as an instrument is well-poised to drive development. Enova will therefore prioritise triggering market changes in the direction of these missions.

### **Large emission sources must become zero-emission without affecting value creation**

Without industry, we will lose large segments of the value creation forming the basis for our society. Norway grinds to a halt without transport. Both of these sectors will still play key roles in a low-emission society, but in order for them to fit in this future scenario, they will have to undergo significant changes as regards emissions. These sectors will have to transition just like the rest of Norway, so we might as well attempt to do it in a way that can be profitable for Norway.

## The market chooses zero-emission industry

The substantial greenhouse gas emissions from industry must be drastically cut in order for Norway to reach its climate obligations. At the same time, it is important to maintain and further develop activity in the sector, because industry is particularly important for Norway in the form of both value creation and employment. The sector must therefore cut emissions while simultaneously creating new values. This is a formidable, but necessary task.

In the process industry, current production processes 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 unclear. 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 for the industry to embrace. In order to succeed by 2050, it is therefore critical that the necessary innovation processes for zero-emission technologies start now.

Norwegian industry has an international orientation, and is in many areas a world leader with regard to energy transition and improving energy efficiency. This, in combination with expert groups both in industry and research communities, will put the industry in a unique position to actually invest in next generation technologies.

### Electrifying mineral wool production in Moss

So far, Enova has not seen enough of the truly ground-breaking, necessary initiatives that can take the industry into a low-emission society, but one of those is Rockwool, which wants to make its mineral wool factory in Moss a global example. With just over NOK 100 million in support from Enova, the world's largest mineral wool manufacturer will utilise new melting furnace technology that will reduce current greenhouse gas emissions by more than 80 per cent, by using electricity as source of energy rather than coke. The pilot project in Moss will provide the corporation

with practical experience with the technology, and could contribute to considerable emission cuts in their other factories around the world.

In addition to cutting emissions and verifying the technology, Rockwool aspires to recycle mineral wool waste from Norwegian construction sites and reuse cuttings and waste from the spinner process in production. This will provide better resource utilisation overall.

## The market chooses zero-emission vessels

Emission cuts within the transport sector are crucial for Norway to deliver on its international climate commitments. The objective of a low-emission society in 2050 means that emissions from maritime transport must be ratcheted down toward zero.

Technology development in maritime transport also represents good opportunities for value creation for Norway. 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 to provide the solutions the world needs.

In order for renewable solutions to outcompete the fossil ones, ideally by being both cheaper and better, we have to see changes in both the vessel and infrastructure segments.

If zero-emission vessels are going to be realised in the future, we still need to see development in a range of technologies – for example batteries, hydrogen and biogas. Regardless of which zero emission technologies are successful, they will all require new infrastructure on land: onshore power and battery charging with direct use of electricity, and top-off facilities for other alternatives. Technology development and further cost reductions for onshore power and charging technologies will be important for the electrification that is taking place, particularly within the ferry segment that sets major requirements for rapid charging due to the short turn-around time at dock. There is often a chicken-and-the-egg issue between supply and demand associated with onshore infrastructure. There have been few incentives to adapt vessels to onshore power, as this option has been absent in ports. Similarly, it has been difficult for the ports to see the economic upside of building onshore power facilities when there are so few vessels with connection opportunities on board.

The Norwegian maritime industry has taken an international position, particularly in battery technology, and the electrification is in the process of gaining a foothold in Norway. An increasing number of vessels are now being built or modified

with batteries on board, and the technology is spreading to new segments of vessels. Fully electric, chargeable and battery-hybrid solutions have been installed within the passenger ferry, aquaculture, fisheries, offshore and cruise segments.

### Nordland receiving its first hybrid ferry

Ferries are well-suited for electrification, as these are vessels that operate in fixed routes over relatively short distances. However, because these routes are very energy-intensive and turn-around times at quay are often measures in minutes, there is a need for highly efficient charging technology.

In recent years, Enova has contributed to the electrification of about 30 ferry routes, and we have already seen that the charging technology has developed considerably since the first awards. Tenders are now being announced for ferry routes that will be established with low and zero-emission solutions through full-electric or plug-in hybrid ferries in multiple counties, and by 2022, Norway will have 70 fully or partially electric ferries. In 2018, we e.g. issued a funding commitment to Nordland county authority totalling just over NOK 25 million for a charging

facility for the county's first plug-in hybrid ferry. Now the Tjøtta–Forvik ferry route along the Coastal Highway will be about 80 per cent electric.

In addition to new technology in next generation ferries cutting vast emissions, we are seeing ferry projects drive the development forward, including in the maritime sector in general. For Enova, creating growth in this value chain is therefore equally important in each individual ferry project. In order to attract more suppliers and continue to build this market in the direction of a low-emission society, it is important for the authorities and principals to send clear signals to the effect that electrification is the way to go. It is therefore positive that counties such as Nordland are helping to lead the way with their high ambitions.

## The market chooses zero-emission vehicles

The means of transport are increasingly energy-efficient, but these climate gains have so far been eclipsed by increased volumes of transport. Projections from CenSES, the Centre for Sustainable Energy Studies, indicate a substantial growth in road traffic in the years to come, well outpacing population growth. Without drastically cutting the emission intensity for each means of transport, emissions from road traffic will therefore increase moving forward. Road transport is an invaluable service for all other sectors, not least for industry, and it is therefore crucial for the objective of a well-functioning, emission-free industry sector that the associated transport is also transitioned toward zero emissions.

In order for zero-emission alternatives to be competitive, there is a need for technology development in the vehicle segment, particularly for heavier vehicles and construction machinery. If we want more people to acquire and use zero-emission vehicles, we also need accessible, competitive infrastructure,

such as charging opportunities for electric vehicles and filling stations for other alternative fuels.

The passenger car market has taken the lead in electrifying the transport sector. With the assistance of various economic incentives from the authorities, such as exemption from VAT, road tax, parking and road toll charges, fully-electric vehicles now account for more than 40 per cent of new vehicle sales in certain months. In this area, Norway is leading by example internationally for the transition to emission-free passenger transport, and we have to build on this experience. We can also play an equivalent role within heavier vehicles that transport 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 primary role in the onshore part might be our contribution to create demand.

## A changing biogas market

Biogas is already a good alternative for many heavier vehicles, and the range of gas vehicle models has improved over the last year. But which transporters would invest in gas vehicles if there is an inadequate number of filling stations? And who will build filling stations if there aren't enough customers and not enough biogas is produced? And who will build plants to produce biogas if there aren't enough buyers?

In such instances, with dependencies in both directions along an entire value chain, it will take a lot for the market to solve the task on its own. Through policy instruments ranging from investment support for biogas production to procurement of biogas-operated vehicles, Enova cooperates with forward-leaning market players to build a competitive value chain for biogas in Norway.

In 2018, Enova e.g. provided NOK 3 million in support to transporters Tine and Litra to procure 10 and 4 gas-operated lorries, respectively. Both companies had then signed letters of intent with Skagerak Naturgass to use a new filling station on E18 in Vestfold County, a filling station made possible by NOK 6 million in Enova support. In turn, Skagerak Naturgass will purchase the biogas from Den Magiske Fabrikken (biogas factory) and VEAS, which have both received support from Enova to establish production facilities.

First of all, this example shows that the biogas market is changing. Secondly, we are seeing how interaction between interested players in the value chain and between the players and Enova is needed to make things happen.

## Preconditions for electrification

Without a sufficient volume of energy to cover consumption, societal development will eventually stagnate. This is also true for a low-emission society. In 2050, onshore activity will account for a larger share of Norwegian value creation than is the case today, and this will be far more energy-intensive value creation than the current activity in the North Sea. An electrified transport sector will also have entirely new requirements for both energy and load. In other words, the low-emission society will require substantial volumes of energy, and this energy will need to be renewable.

If Norway succeeds in electrifying the transport sector and the industry, we will have solved a considerable emissions issue, but this will simultaneously pose new challenges in the energy sector. Enova will contribute to ensure that this transition is quicker, simpler and cheaper, and an important precondition for achieving this is to avoid making the energy system a bottleneck. The Norwegian energy system is resilient and security of supply is good, but this could be challenged in the face of an increased need for the electric energy and load represented by a major electrification. Higher levels of inflexible power such as wind and solar, as well as more local production, will amplify this scenario and set more stringent demands for a dynamic energy system.

The simple solution is to build new power generation and increase transmission capacity. This is also a solution that will entail very costly investments that will ultimately benefit

the end user. Right now, we have more than enough available electricity in Norway, and because the energy system has to be designed for the coldest winter days, when the peak demand is highest, there is also considerable available capacity in the grid for large parts of the year. This is why there are considerable savings to be had by using the energy system in a better and more efficient manner through new technology and new business models, rather than building costly infrastructure for the most demanding hours of the year.

The energy system Norway will need in 2050 is not fully understood, and although it is difficult to project how we should design for various needs, we are aware of a few characteristics the energy system should have. Moving forward, it will be increasingly important to carry out measures that reduce strain in the power system and increase demand-side flexibility. Important contributions here will be to improve energy efficiency and ultimately utilise our renewable energy resources in an efficient manner. All these areas will have the need to develop and test new technology and new services, to see what works in practice and build on that.

All in all: If we are going to electrify society, the necessary preconditions will be to cut energy consumption where we can, distribute the demand consumption as much as possible, and produce new renewable power in an efficient manner where this is sensible.

## The market chooses to use energy and resources efficiently

Reduced greenhouse gas emissions and the use of energy and other resources are closely related, and all sectors can use energy and resources more efficiently. The potential for profitable energy efficiency measures is considerable.

The profitable potential for efficient use of energy and resources must be utilised. Norway has come relatively far in energy efficiency measures, but the industry still has significant potential within waste heat. Much of this waste heat is too cold to be used to generate electricity, but may still have value when used as alternative heating in the form of e.g. district heating or in the actual industrial process. This shows that efficient utilisation of resources also reduces strain in the electric grid. It is also possible to utilise structural trends 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.

The efficiency potential can also be increased by developing and using new technology. New digital power meters provide more data. These data must be utilised such that both suppliers and end users are capable of making better choices. New technology within artificial intelligence can also be used to automate solutions that boost energy efficiency, for example by coordinating the building's systems for ventilation, lighting and heat. Energy exchange between buildings is another efficiency solution the beginnings of which we have only barely seen.

### The Rema 1000 distribution centre in Sandnes produces renewable energy and uses it efficiently with the aid of both batteries and an accumulator tank

In Sandnes in Rogaland County, Login Eiendom erected a future-oriented warehouse building with NOK 12.9 million in support from Enova which uses familiar technology in new ways. This warehouse building is equipped with solar cells, batteries and a 300,000-litre accumulator tank (which is also a sprinkler tank) used as thermal energy storage. The accumulator tank also switches between summer and winter operation. In the summer, when the battery is fully charged, the surplus energy is stored as cold energy in the water tank. At night, this cold water can take over some of the cooling plant's load. The surplus heat from the cooling plant also helps in heating other parts of the building. In addition, the system predicts the warehouse building's energy consumption

and production based on the weather report, anticipated energy/peak demand prices and patterns of operation, and in response adapts the energy storage and consumption. This is the first time prognosis management and an accumulator tank have been used in this way in Norway.

Overall, the innovative solutions ensure that the building's energy demand is particularly low, and keep the passive house quality building self-sufficient as regards heat. This model project sets a new standard for both prognosis management of air conditioners, warehouse automation, utilising surplus heat and using new solar cell technology, and shows solutions in practice that are relevant for many.

## The market chooses to utilise the flexibility in the energy system

There are considerable opportunities to better utilise current flexibility in the energy system, in addition to the potential for developing new solutions that contribute to increased flexibility. New technology and new services must be put to use and further developed to ensure more efficient use of the energy system. This applies throughout the value chain – from the major producers and consumers, via grid infrastructure, and finally to the end user. In order to achieve this, we will need more than new technology; it is also important to have players in the value chain sit down together and come up with good solutions.

Better interaction between the power system and thermal energy systems will also contribute to a cost-effective and flexible energy system. In addition to the fact that when we use

types of energy other than electric energy for heating, we reduce the need for electricity, is it also positive for security of supply because it gives us more 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 changed 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 be proven that new solutions work and are robust.

Enova will contribute to this by alleviating the risk for players

who want to develop and use new technology, new solutions and new business models to exploit and bolster flexibility in the energy system.

### Bolstering security of supply on Senja island without reinforcing the grid

The communities of Senjahopen and Husøy on Senja are vulnerable to power failures and generally have a considerable need for power grid reinforcements. Led by Troms Kraft Nett, a consortium consisting of ten different players has received NOK 0.9 million in Enova support for a concept assessment to study grid reinforcement alternatives. The project consists of the regional grid company, a specialist in energy storage in power grids, a software provider, as well as a specialist in the energy market and solar power generation.

The sale of local businesses' surplus power and storage of electricity in the distribution grid will involve a number of physical and formal challenges, and this project will attempt to find solutions. The project is considering opportunities for a local flexibility market, and locally-produced solar and wind energy, as well as load shifting and management. Industrial businesses are particularly suited for peak demand pricing, but residential and commercial customers are also included in the project. Over time, the project could provide important experience in what can be done to find the optimum development strategy for grids in sparsely populated areas.

## The market chooses to utilise renewable resources

In a low-emission society, our energy consumption must be based on renewable energy resources, and the resources we have must be used efficiently. This requires further development of technologies for both renewable power generation and technologies that contribute to the use of renewable resources for other energy consumption, such as biofuels and other energy carriers.

Norway is likely, even with considerable and successful efforts to streamline both energy and demand consumption, to have a need for more renewable energy on the road toward a low-emission

society. Enova must contribute to ensure that new solutions and new technology to increase the production of renewable power and other utilisation of renewable resources are developed and utilised.

In addition to increased power generation being positive for security of supply, there may also be a commercial potential for Norwegian industry. An example of this could be technology projects within floating offshore wind, where the existing expertise Norway has developed offshore can be used to develop new solutions the world needs, and which also contribute to revenues for Norway.

### Off-grid micro-grid at Byneset

TrønderEnergi Nett deals in electricity products for micro-grids (off-grid solution) as alternatives in places where connection to the power grid is socio-economically challenging. With NOK 5 million in support from Enova, the company will be realising a micro-grid at Byneset in Trondheim which will be completely separate from the distribution grid. This pilot project will include both wind, solar, batteries and hydrogen, and this complexity and size make it the first of its kind in Norway. Micro-grids like this will contribute to increased generation from renewable energy sources, lower emissions from diesel generators and less need for investment and development of the power grid.

Local energy generation is not constant and varies considerably. It is challenging to get new technology to work well for those who need energy year-round. Entirely new solutions for management are needed in order to provide end users with a stable power supply. The project will therefore test

that the system satisfies requirements for electricity supply that apply for the Norwegian main grid as regards protection, reliability of supply and delivery quality.

A successful demonstration will reduce the technological risk so that the technology can be moved to the Froan archipelago in Frøya municipality to make the Sørburøy, Nordøy and Sauøy islands self-sufficient. Such a move to Froan will be contingent on public permits for setting up turbines.

Solutions like this could fully replace connection to the distribution grid in sparsely populated areas, but can also be established in more semi-urban areas where the power grid has little capacity. Fish farming facilities, lighthouses, island communities, cabin communities and new residential areas are instances where micro-grids could be relevant, and where fossil alternatives such as diesel generators can be replaced.

# The solution is in the markets

The demand for goods and services is driving greenhouse gas emissions. The six missions Enova has prioritised are all based on the market, and require efforts from all sectors of Norwegian business. In order for the market to choose to invest in sustainable solutions, the players must see a long-term value creation potential in replacing fossil alternatives with renewable solutions. Enova's job here is to 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 the general changes into efforts and targeted activities that trigger necessary actions in the right markets. This means that Enova must be aware of the challenges that characterise the different sectors and prevent the necessary changes from occurring. We have therefore prepared a summary of the sectors' market outlooks as we perceive them, and published this on our website [enova.no](http://enova.no).

Over the next few pages, we will describe which activities Enova will prioritise moving forward in the most important sectors we work with.



**The transition to a low-emission society will require technology development and utilising both new and known solutions in a larger scope than today. The necessary changes will take time and will require an appetite for both investment and risk in the industry. This is why Enova sets long-term goals for itself to stimulate the industry's road to a low-emission society. We must design our policy instruments to ensure that players who want to focus on developing new and future-oriented energy and climate technology benefit from predictability as regards risk mitigation where this is needed.**

Moving forward, Enova will contribute to more rapid introduction of new energy and climate technology in 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 assume a considerable financial risk. We will also work for efficient energy use in 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 in technology development and production. Enova will prioritise the following moving forward:

## Competitive zero and low-emission technology in industrial processes

Enova's most important goal in industry is to facilitate transitioning the industry's processes to competitive zero or low-emission technology. This could involve developing the current core processes, developing new production processes or development and increasing availability of bio-based input factors for the processes that cannot occur without carbon.

Enova's goal is for our policy instruments to contribute to the necessary changes that must occur in the various industry segments, thus ensuring that low and zero-emission technologies can be ready for use before 2030, and on track for the industry to be emission-free by 2050. Our instruments must help expedite innovation processes in industry, which will enable individual players to cut their emissions, in addition to driving the technology front for climate-friendly technology, which will, over time, provide significant cuts when it is used on a national and international scale.

The development that must occur in the industrial processes requires lengthy and cost-intensive development cycles. The market is characterised by a handful of large players in each segment, with somewhat proprietary technology. Taking the step from lab-scale to full-scale demonstration and onward to commercial implementation is time-consuming and capital-intensive, and is largely controlled by the industry's own technology development cycles and investment portfolios. Enova has a limited ability to exert impact when the different steps occur, which is why we follow the technology status in all major industry segments, and maintain a running dialogue with the key players. This is how we will ensure that our instruments are targeted and tailored in relation to the industry's need when the projects are ready, and provide risk mitigation to players that want to take the lead.

### Sustainable energy and resource utilisation

In order to reach a low-emission society, industry will also have to produce with significantly lower energy consumption than is the case today. This will require new development and improvement of industrial processes, but also substantially reduced losses of energy and material resources through increased utilisation of waste streams. The goal of an emission-free industry must be reached through significantly improved and more sustainable core and auxiliary processes, but also through smarter use of energy and material resources both in and across enterprises. We expect efficient energy and demand consumption interacting with the energy system will be an important part of the solution.

The industry must be characterised by sustainable energy and resource utilisation in 2050, but there is already considerable potential for using new energy and climate-efficient solutions. Enova will therefore contribute to ensure that the industry further develops and utilises it. For example, this could involve technology or solutions for increased utilisation of waste heat for power or heat purposes, renewable solutions for process heat or other solutions that contribute to efficient and climate-friendly energy consumption.

Many of the technologies and solutions have broad areas of application and are already known today. In many instances, the technologies are technologically mature, but need commercial maturation before they are widely adopted in the market. We expect that an increased volume of installations, along with standardised solutions, will reduce costs and could, over time, make such investments profitable even without support.

Enova wants to stimulate an increased volume of such projects and increased market awareness as regards energy and climate-efficient solutions. We will direct our efforts where we, at any given time, believe the possibility of influencing the market in the desired direction is greatest. This is why we will closely follow the number of installations and the cost development for individual technologies and solutions. In order to follow the development, we use publicly available statistics (for example from Statistics Norway) and supplement with our own studies and analyses, as well as information we receive continuously from projects we have supported.

## Transport



**Enova wants to contribute to assist the transport sector in changing and moving in the direction of the low-emission society. We will do this by stimulating development and cost reductions throughout the value chain as regards battery hybrid and battery electric solutions. At the same time, there will be a need for multiple kinds of technologies and energy carriers, such as electricity, hydrogen and biogas, if we are to reach Norway's ambitions as regards adapting to a low-emission society within the transport sector as well. 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.**

In many cases, there will be a need for changes in one market in order to make progress in another. As regards ship types that still depend on fossil fuels, onshore power and biogas could play a role in reducing greenhouse gas emissions until competitive zero-emission solutions are developed.

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 factors could affect this development. For most transport segments, particularly road transport, Norway is dependent on international technology development. Changes in the global markets also have a substantial effect on the pace of development in the Norwegian transport sector.

Enova will prioritise the following moving forward:

### Competitive zero-emission vessels

Shipping is a significant contributor to greenhouse gas emissions, both nationally and internationally. Norway is a major maritime nation where the entire maritime value chain is represented, including shipping companies, shipyards and equipment suppliers. On this basis, Norway is in a unique position to influence technology development in the industry on a global scale, and could, over time, change the market for zero-emission vessels. A significant

development as regards electrification has already occurred on the vessel side, particularly for ferries and offshore supply vessels. Nevertheless, there is still a need for higher levels of hybridisation and, over time, transitioning to clean zero-emission technology. At the same time, it is still expensive to choose batteries.

Enova's support schemes must contribute to ensure that commercial use of batteries in ships takes place more rapidly and in an increased scope than would otherwise be the case, and to ensure that battery solutions are more available in the market. An increased market volume will help build the supply side of the market, and provide a basis for further development and greater competitiveness. The goal is for battery solutions to be the preferred choice without support, leading to reduced emissions and more energy and climate-efficient shipping on the road to a low-emission society.

Enova will follow up this effort by e.g. measuring the number of vessels with batteries within different segments, the degree of hybridisation, and the support percentage needed within different segments in order for the investment in zero-emission vessels to be competitive.

### **Sustainable market for onshore power**

The emissions from ships at quay are extensive. The use of onshore power contributes to increased energy efficiency measures and reduced greenhouse gas emissions when ships are at quay. In addition to reducing local emissions of greenhouse gases, onshore power is a positive contribution for further electrification of shipping. Increased access to onshore power at Norwegian ports will contribute to vessels increasingly being built or adapted so that they are facilitated for connection.

Enova provides investment support to establish onshore power facilities at Norwegian ports, and will also consider the need for support for charging infrastructure as larger numbers of vessels have battery solutions.

Enova will follow up these efforts e.g. by measuring the number of ships equipped with onshore power connectors, how many ports provide onshore power and how much existing facilities are used.

### **Competitive zero-emission vehicles**

Ground transport accounts for the largest share of Norway's emissions not subject to carbon credits. There is a need for technology development on the vehicle side in order to create competitive alternatives for zero emissions - this is particularly true for heavier vehicles and construction machinery. Enova will contribute to ensure that energy and climate-efficient solutions become more readily available on the market, and that they are put to use more rapidly and in a larger scope than they otherwise would be, and thus contributing toward disseminating information about these technologies and their properties. At the same time, an increased market volume will help build the supply side of the market, provide a basis for

gradual improvement and eventually bolster the competitive situation vis-à-vis conventional solutions.

Enova will follow up these efforts e.g. by measuring the percentage of newly registered vehicles that use hydrogen, electricity and biogas within different vehicle segments, as well as the support percentage needed within different segments in order for the investment in zero-emission vehicles to be competitive.

### **Sustainable market for fast charging**

Fast charging will contribute to reduced greenhouse gas emissions from the transport sector and stimulate more people to purchase and use electric vehicles. The market for charging infrastructure is developing on par with the increase in the number of electric vehicles, and infrastructure for charging electric cars is being built today even without support from Enova. However, in many areas with low electric car density, it is still not economically profitable to establish fast charging and there will be a need for economic incentives to avoid access to charging infrastructure becoming a barrier for the transition to electric vehicles.

Enova will follow up these efforts e.g. by measuring the spread of commercially available charging options with and without support from Enova, and the geographical distribution of fast chargers.

### **Sustainable market for hydrogen for transport purposes**

Hydrogen as an energy carrier has considerable potential for the transport sector, within both ground transport and the maritime sector. However, the future outlook is uncertain as the technology is still not mature. The development of hydrogen as a fuel for vehicles depends on technology and market development outside Norway. Hydrogen as an energy carrier is even more immature for use at sea, but this is also where Norway has a better possibility of contributing technology development.

Enova supports the establishment of publicly available hydrogen filling points to facilitate increased use of hydrogen-electric vehicles, as well as to contribute to learning from the use of hydrogen as fuel in the transport sector. The objective here will be to reduce the risk and cost of putting hydrogen technology to use. Enova can also provide support for technology development in the area.

Enova will monitor the development in hydrogen for transport purposes e.g. by measuring the number of newly registered vehicles and the number of vessels using hydrogen as an energy carrier within different segments, as well as the number of available hydrogen filling points and their use.

### **Climate-neutral public transport services**

Greenhouse gas emissions from public transport services are considerable. Mature technology exists today that can reduce and avoid

emissions, but this entails somewhat increased costs. However, public procurement of transport services is substantially influenced by political constraints and requirements, and not merely profitability. This means that the government can take a greater risk on technology and economics than private players. Public procurement of climate-friendly transport services could therefore be a considerable driver that also signals a direction to market players in general. This is why Enova provides support for establishing infrastructure for municipal and county authority transport services.

For Enova, it is important to contribute to market change in the direction of climate-neutral public transport services, not only to reduce related greenhouse gas emissions, but also because this market change will have synergy effects for the goals concerning competitive zero-emission vessels and vehicles. Public players that take the lead and use climate-friendly solutions will contribute to an acceleration for technology and market development in the general area.

Enova will follow up these efforts associated with climate-neutral public transport services by monitoring tendering processes and cost development related to the choice of climate-friendly solutions in public tenders.

## Competitive value chain for biogas and fuel

Biogas and fuel can contribute to phasing out the use of fossil fuels, and are a good alternative, particularly for heavier vehicles. The fuel is not currently competitive on price, and there is a need for technology development on the production side. We can presume that when biogas production can take place on commercial terms with considerable volumes and sufficient infrastructure, biogas will be used on a significant scale by end users in segments where biogas is a good alternative. Biofuels, equivalently, can be used on a significant scale by end users with fossil motors.

Enova wants to contribute to increased production of sustainable biogas and biofuel with a considerable market potential. There is also a need for market development on the vehicle side to ensure competitive alternatives. Enova can provide support for heavier biogas-operated vehicles and construction machinery to help promote the technology, as well as contribute to building the supply side of the market and thus, through gradual improvement, bolster the competitive situation vis-à-vis conventional solutions.

Enova will follow up the development within biogas and fuel by measuring the number of newly registered biogas vehicles within different segments, and costs for biogas and biofuels compared with conventional fuel.

## Energy system



**In the period leading up to 2030, Enova aims for our instruments to speed up the necessary changes in the direction of low and zero-emission technology for the different sectors, so that these technologies can be utilised to a sufficient extent by 2050. To achieve this, we need a flexible, secure and renewable energy system. The energy system will therefore be an important premise for development in sectors such as industry, transport and non-residential and residential buildings.**

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 aimed at the energy sector will support the other sectors' needs as regards electricity supply, reduced greenhouse gas emissions, reduced peak demand, better 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.

Enova will prioritise the following moving forward:

### Profitable solutions and market for flexibility

On the road towards a low emission society, it is crucial to ensure that the underlying energy system is flexible enough in order for new solutions to be implemented and utilised to an optimal extent. Enova will contribute toward developing the energy system in line with the changes we observe, which are e.g. driven by accelerating digitalisation. Once the full AMS roll-out is complete in 2018, the market players are expected to considerably increase their knowledge concerning energy flow and peak demand in the system. This new information will

provide opportunities to implement measures and complete new customised projects.

The energy system is being increasingly electrified. This development means that the currently unused flexibility in all sectors must be utilised in order to satisfy the demand. Efficient utilisation of these flexibility resources is socio-economically profitable. By establishing flexibility markets where available flexibility is sold and priced based on power grid capacity, we will have market-driven solutions that provide opportunities for new players, new business models and new technology.

It is risky and costly to utilise new solutions and establish flexibility markets, because it will be uncertain how well the technology or business models work on a large scale and under actual operating conditions. In order to verify that it works at the system level, we have to go beyond small-scale testing. Enova will help break down this barrier through large-scale demonstrations under actual operating conditions where flexibility utilisation and markets are key topics. Our technology-neutral programmes will also allow us to support projects from an early phase to full-scale development.

Enova will monitor market developments over time. Among other things, we will follow the development in the number of suppliers providing flexibility services (aggregators) and the different kinds of market solutions that are established.

### **Expanding thermal infrastructure and interaction between electric and thermal energy**

The maximum peak demand in the energy system on the coldest days is now driving power developments. The peak demand is rising faster than energy consumption, and this development is expected to continue. It is costly to develop grid capacity to cover the full thermal need for these few hours, and more rational to use thermal energy for temperature-dependent consumption.

The capital structure of district heating, with high basic investments and stepwise investments, coupled with low marginal costs and low long-term marginal costs, results in high initial commercial risk and high costs. This means that investments that are socio-economically profitable might not be chosen.

Enova will therefore provide support for district heating projects with a focus on new technology and/or new business models that contribute to the expansion of thermal

infrastructure and better interaction between thermal and electric energy. There will be a particular focus on innovation and business development that includes thermal storage, different solutions that involve heat for cooling, as well as low-temperature systems and new areas of application for district heating, for example district heating for cruise ships and construction sites.

Pure infrastructure projects, where district heating is established for the first time, will still be offered investment support. We will provide support for concept assessments to ensure that district heating and power producers, grid companies and developers come together early in the development of an area. This increases the likelihood of the market choosing solutions that ensure optimal interaction between the electric and thermal infrastructure.

Enova will follow up these efforts e.g. by monitoring the development in number of kilometres of district heating in Norway, the percentage of projects that have utilised new interaction concepts between thermal and electric energy, and the share of district heating in the energy market.

### **Increased innovation and utilisation of renewable energy sources**

In order to ensure that the energy system is not an impediment for the necessary market changes in the other sectors, it will be important for the energy sector to pursue efficient resource utilisation, innovation and more renewable power generation.

Predicting the energy system of 2050 is complicated at the best of times. This depends on a number of factors, including settlement patterns, how we live, work and what kind of transportation we use in 2050. In the same vein, the future energy system will depend on how we handle the consumption of ecological resources, which energy sources we use and what our power generation mix will be in 2050. This is a question we cannot answer today, but what we know is that these answers will require innovation within different parts of power generation. The low-emission society will need energy carriers other than oil and gas, and our technology-neutral programmes will allow us to support projects from an early phase to full-scale development. Here we will prioritise innovation within different technologies for renewable power generation.

Enova will follow up these efforts and market development e.g. by monitoring the development in installed capacity for renewable power generation.

# 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 economic 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.

Enova has extensive experience with policy instruments aimed at the construction and property sector. This experience, 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. We will direct our efforts toward the areas we believe will have the most impact on the market.

Enova will prioritise the following moving forward:

## A growing, profitable energy service market

The commercially profitable potential for reducing energy consumption in existing buildings is a meagre 9 TWh<sup>4</sup>, and roughly constitutes a potential market of 5 billion annually. However, the sector is facing a number of barriers, which means that not even profitable measures are implemented. One key barrier is the lack of expertise and low interest from building owners, in part as a result of the low value of individual measures. In spite of goal-oriented policy instruments targeting these barriers through information and support for surveys and measures, much of the potential remains unrealised. This is why Enova is shifting part of its efforts toward stimulating business development for professional players that can do business on the barriers, and thus kick-start the market. Enova uses the term energy service market to describe this industry.

As regards the public sector, Enova has worked in a goal-oriented manner for a number of years on energy service contracts in the form of EPCs<sup>5</sup>. Experience from this indicates that the municipalities that carry out energy efficiency

measures such as EPCs have succeeded in reaching the objectives in their energy and climate plans to a greater extent than municipalities that have not used such comprehensive service concepts. Enova thinks digitalisation of buildings and energy systems, along with increased climate focus and future requirements from the finance industry will also trigger more momentum for this type of business model in the private sector. We want to stimulate these forces to develop existing buildings in the direction of a low-emission society.

Enova will follow up these efforts e.g. by carrying out surveys to count the number of players, revenues, degree of profitability, and regional expansion. Enova also has an internal database with an overview of all completed EPC projects in Norway.

## Energy efficiency measures mean choosing the best available technology

In order to further reduce the need for energy in buildings, increasingly improved technologies and products must be successful in the market. Creating incentives for increased demand for the best available technology will be an important task in order to increase market volume, reduce prices and ensure that the good solutions become the standard for next generation building rehabilitation. Enova will therefore stimulate the market to ensure that a sufficient share of turnover is associated with the current best available technology. The development in solutions is continuous and here Enova will carry out annual updates of which measure categories will be included and what is considered to be the best available technology at any given time.

Enova will follow up these efforts in the market e.g. by conducting measurements of the percentage of revenue for building owners, suppliers and contractors linked to the best available technology. Annual analyses will allow us to monitor the development in prices and availability of individual measure categories. Enova also has access to considerable information from the large number of projects we have supported, for example the number and type of measures.

## Energy management and climate management as industry standard

Daily operation of Norwegian buildings must have a consistent focus on efficient energy consumption. Energy management in practice is established by measuring the building's temperature-corrected energy consumption, what the energy is used for, setting goals for the future and finding measures to reach these goals. Energy management and energy monitoring systems will be profitable for both society and building owners. Enova will

<sup>4</sup> From Enova's Potential and Barrier Study 2012

<sup>5</sup> EPC is short for Energy Performance Contracting, which means energy saving contracts with guaranteed savings. PPP is short for Public-Private Partnership, a form of collaboration in which the state pays private companies over a longer period of time to finance, construct and maintain public buildings.

therefore stimulate the establishment of energy management and climate management as standards.

Enova will follow up these efforts to see whether building owners succeed in establishing energy management in their activities. Establishing energy and climate management is not directly quantifiable, but we will follow this up e.g. through the Energy Certification Programme and the annual building statistics<sup>6</sup>. This could provide a few indications as to whether energy management leads to reduced energy consumption for the players.

### **Increased innovation in the construction sector that contributes to reduced energy consumption, demand load and environmental impact**

Enova will stimulate the pioneers to push themselves further to show the rest of the industry what is possible. When the pioneers are willing to take risks by developing and testing the new solutions, this could both advertise the new solutions and make them cheaper. This could be what it takes for the

solution, whether this be a new technology or new business model, to break through in the market. Enova will follow up these efforts e.g. through information from the Energy Certification Programme indicating the number of players choosing solutions significantly beyond the TEK standard. This provides an indication of how many players are choosing innovative energy solutions. 2018 also saw the publication of a guideline for climate-friendly construction sites and a method for greenhouse gas calculations for buildings, which can set standards to which the players must aspire. Such standards, alongside Enova's policy instruments, are important drivers for increasing the pace of innovation in the construction sector. The building owners themselves will have to contribute the majority of investment capital in order to realise projects. The support programmes therefore provide information about how much innovation capital we contribute to trigger the market to increase the pace of innovation and reduce energy consumption, demand load and environmental impact in the non-residential buildings and property sector.

## 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.**

Enova will prioritise the following moving forward:

### **Upgrading to the current energy standard is becoming normal when homes are renovated**

The majority of Norwegian residences are still single-family homes, and we believe this will remain the case in the future. Out of a total of 1.2 million Norwegian single-family houses, 0.5 million were built during the period 1946-1980 and have a poor energy standard compared with the current requirements for new buildings. Each year, Norwegian homeowners spend about NOK 75 billion on renovations and upgrades - 62 per cent of this is related to single-family houses.

A survey conducted by Enova in 2015 shows that less than 50 per cent of the renovation projects complete energy upgrades

as a part of the work. The more families who insulate and choose windows and doors with high energy quality when they renovate, the more robust Norway's residences will be in the future. Buildings with a low heating demand have a significant impact for energy and peak demand in the power grid, particularly during winter.

Enova shall stimulate the market so that energy upgrades with a high energy ambition will become standard for a renovation project. In order to achieve this, the emergence of a market for energy advisers who can make a plan for energy measures before the upgrade starts will be stimulated. We also grant subsidies to comprehensive upgrades with a high energy ambition, to develop both the buyer and supplier sides in the renovation market. Subsidies are also granted for retrofitting balanced ventilation with heat recovery. The funding scheme is coordinated with the Energy Certification Programme to highlight energy level and the value of an energy-efficient residence.

In order to measure the development in energy ambition in the ROT market (renovation, modification and additions), Enova e.g. follows the use of materials in renovation projects and the ratio of energy upgrades.

<sup>6</sup> Enova publishes annual building statistics showing temperature-corrected consumption in different building categories to assist in benchmarking between companies.

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

Depending on the type and age of the residence, between 50 and 80 per cent of the energy consumption in residences comes from heating. Energy consumption is highest on the coldest days, and this is when the strain in the Norwegian power grid is highest. In order to reduce the high demand load in the power grid, it is important that the heating systems are flexible and can 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 affecting comfort. The possibility of using locally stored energy, such as wood and pellets, can also ease the strain on the power grid during potential peak periods.

Starting in 2020, fossil fuel oil will be prohibited in residences and buildings. Increased fees on fossil oil from 2014, along with support programmes from Enova, have motivated homeowners to replace oil furnaces with climate-friendly alternatives, but in early 2018 there are still about 80,000 residences with various forms of oil heating.

It is important that the many oil heating plants that are replaced as a result of the ban on fossil heating are replaced with solutions that place the least possible strain on the power grid. Enova also grants subsidies for various heating plants that supply water-borne heating, and for modification to a water-borne heating system in existing residences.

In order to monitor the development toward prohibition, Enova will e.g. follow the sale bio-based heat sources and heat pumps. We also monitor the sale of fuel oil and paraffin.

## A well-functioning market for demand flexibility in the sector

Peak demand has increased significantly more than energy drawn from the Norwegian power grid over the last few decades. There is a major potential in extracting the flexibility in electricity consumption in Norwegian households. Until the 1980s, demand flexibility in homes was controlled manually

by homeowners. An analogous wattmeter, most frequently located in the kitchen, showed demand consumption and the limit for the subscribed demand load. The homeowner then connected and disconnected the water heater, heating cables and other loads to avoid high energy prices. Since the two-tier price system for electricity in households was phased out in the 1980s, there have been no equivalent incentives for homeowners to limit maximum peak demand, but digital power meters and the last few decades of digitalisation now mean that the same management can take place automatically without this coming at the expense of comfort for residents.

By now, about 2.5 million homes and 320,000 holiday homes should be equipped with digital AMS meters. The meters will deliver data to the “El-hub” database, and this new way of measuring power and peak demand will be an important facilitator for innovation and service development. NVE is also working on a regulation to stipulate peak demand tariffs in the household market.

Enova shall stimulate consumers to start using new technologies and services that will emerge in the aftermath of AMS and peak demand pricing. This is how the unused flexibility in demand consumption will be extracted. Enova’s work must be coordinated with other instruments, and we will initially emphasise testing of technology and services based on the AMS technology. When AMS meters have been fully installed and peak demand pricing increases the interest in demand management, Enova will get involved in development of the market for technology and services.

In addition to initiating projects where players on the supplier side test services based on AMS technology, Enova will inform homeowners about why flexible demand consumption is important and about how this may be solved through smart management systems. So far, we are following homeowners’ attitudes toward automatic control of home energy consumption. When the framework for peak demand tariffs is in place, we will track the market development for technology and services.





# **PART VI**

# **ANNUAL REPORT AND**

# **ANNUAL ACCOUNTS**

# **FOR ENOVA SF**

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Part VI Annual report and annual accounts for Enova SF (page 68-79) has not been translated into English. For information about this, see the Norwegian version.





# PART VII ANNUAL ACCOUNTS FOR THE ENERGY FUND

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Part VII Annual accounts for the Energy Fund (page 82-86) has not been translated into English. For information about this, see the Norwegian version.





# PART VIII APPENDIX

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89 Definitions and terminology



# Definitions and terminology

## Achieved 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.

## 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 through using internationally recognised GWP factors (Global Warming Potential).

## 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 to a one-tonne emission of CO<sub>2</sub> over a specified period of time, usually 100 years.

## 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.

## 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.

## 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.

## 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 Norwegian 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.

## 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.

## 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 kilowatt (kW).

### 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.

### 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 national 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 national budget.

### 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.



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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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