Local Quality

A strategy for transition to a low-emissions society

LOCAL
QUALITY

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Foreword

The report "Local Quality – A Framework for Local Authorities as Catalysts for the Transition to a Low Emission Society" was prepared by insam as, Civitas, and CICERO as an assignment from Norwegian Association of Local and Regional Authorities (KS) R&D. The project was a part of the municipal sector's follow-up to the climate agreement, which began with the question: What does the transition to a low-emissions society mean for the municipal sector? The low-emissions society described in the climate agreement depends upon Norway achieving an 80-90 percent reduction in emissions by 2050. .

The project was conducted by Lars Wang (project leader) and Reidunn Mygland from insam as, Hege Westskog and Helene Amundsen from CICERO, and Eivind Selvig from Civitas. The contact persons from the contracting entity (KS) were Kjetil Bjørlund and Jørn Inge Dørum. The advisory board in KS functioned as a reference group for the work. The established approach set the low-emissions challenge into a wide societal context. Following that, an interdisciplinary knowledge base grew out of conversations with a diverse selection of informants from both the municipal sector and other stakeholder groups

A great deal of interest followed the launch of the Norwegian report (Kortreist Kvalitet). The authors of the report and the contact persons at KS have presented its contents at over 50 meetings of various types throughout Norway. Politicians, administrative leaders, and different disciplinary areas from Norwegian municipalities have shown a great interest in the work.

The report has also attracted the interest of stakeholders outside the municipal sector. National actors have shown interest in the report's illustration of how the municipal sector can develop ways of working to handle questions across different levels, sectors, stakeholder groups, and measures. Since the original report's completion, the national parliament has approved the climate law (Klimaloven 2017), and strengthened the juridical foundation for the municipalities' transition work. Since 2016, there has also been increasing interest in basing municipal and regional development work upon the UN's sustainability goals.

In 2017, CICERO presented Local Quality at a central research conference directed by the international climate panel (IPCC). The feedback from that conference was that the report's recommendations are aligned with both international developments and updated research connected to climate transition. Corresponding to that, there has also been an increasing international interest in the local level's role in climate work and in the potentials connected to democratic and innovative transition processes.

Developments since Local Quality was first presented are considered to have actualized recommendations from the report. Its success is the background for continued collaboration between KS and the actors behind the report. The collaboration is directed towards further development of the knowledge base for practically implementing Local Quality. Among other things, the collaboration is establishing a national forefront network for municipalities and counties that will work towards transition and societal development based upon the report.

The considerable interest the report has attracted and the desire to further develop the work has sparked the release of a new version of the Norwegian report with unchanged content, but updated graphics. Simultaneously, international interest has led to the report's translation into an English version. Relevant information about the report and the work that follows from it can be found online at www.localquality.org (also in Norwegian at www.kortreistkvalitet.no). These websites will be continuously developed as common resources for everyone wishing to collaborate towards Local Quality.

Oslo 01.09.2018

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Executive summary

The climate challenge. The Paris Agreement from December 2015 and the Norwegian National Climate Agreements (2008 and 2012) have established a consensus on the need for a transition to a low emission society. This implies reducing greenhouse gas emissions to a level equivalent to 1-2 tonnes per capita by 2050, i.e. an 80-90 percent reduction in emissions.

The importance of local government. Through international and national climate policy processes over the last decades, local government has gained a position as an important partner in the transition process. However, the experiences so far also underpin the need to explore and take advantage of the potential of cities and municipalities as leading partners in the transition processes.

Wicked problem. Climate change can be regarded as a contentious, or wicked, problem. Due to its complexity, it is difficult to manage within existing institutions and management strategies. Transition can also imply negative short-term consequences because of conflicting objectives. Stricter land use practice can e.g. give priority to the development of local hubs and city centres and cause a conflict between the need for densification on the one hand and securing urban qualities on the other hand. Wicked problems also represent a challenge when it comes to which questions are to be addressed. Transition to a low emission society is therefore closely linked to a process of reframing and change of mind-set.

Direct as well as indirect emissions. In particular, it is essential to discuss how municipalities can develop solutions that reduce the need for total demand for energy and resources. This means that direct as well as indirect emissions should be includes also in local and regional transition processes. Otherwise reduced direct emission might be compensated by, and even increase, emissions related to external travel, imported goods etc. Therefore, it remains a good strategy to think globally and act locally.

Construction, transportation and food. Construction, transportation, and food are themes that are well suited as point of departure for local transition dialogues. These areas, especially if indirect emissions are taken into account, represent the lion´s share of our emissions, which municipalities can influence. Additionally, these are themes that can be regarded as relevant for local and regional government, civil society businesses and for most people in their daily lives.

Win-win concepts. Most municipalities cannot afford to develop separate "low-emission solution" without approaching them as integrated within municipal services, land use planning, and various investment programs. This implies a need for all kinds of local projects, activities and services to integrate several perspectives and objectives. For example, densification can contribute to greenhouse gas reduction as well as social inclusion, public health, cultural qualities, local business innovation and biodiversity. This approach also represents a potential for more overall cost-effective municipal investment strategies. Win-win concepts should also include necessary actions for securing climate adaption in order to develop local and regional resilience. The need for transition towards a low emissions society can therefore be seen as decisive incentive for societal innovation.

Local quality. The concept "Local quality" reflects a unifying strategy for the transition process. The efforts to reduce greenhouse gas emissions can thus be linked to the focus on local resources. Thus, it can address how environmental, social, and cultural qualities form a sustainable basis for developing an overall far more efficient and locally based circular economy. At the same time, the concept strongly conveys the need for a transition process to be flexible and considering local adaptations and political preferences.

Efficiency, development and transition. It is recommended to work in parallel with transition processes on three levels. These levels can be termed efficiency, development, and transition. Efficiency (level I) means interventions that improve the functioning of different systems (e.g. a building or a car) without changing the system or the underlying concepts. Development (level II) implies changing systems or concepts in areas such as housing and infrastructure; it can be directed at changing preferences such as from the use of private cars to bicycles or trains. There is probably a significant potential for increasing climate efficiency through a more coordinated approach when it comes to different investments in different types of infrastructure. This can also imply developing more-

integrated funding schemes to stimulate low-carbon regional, urban, and area development. Transition (level III) involves developing housing, work, recreation, food, services, etc. in ways that reduce need for energy and resource use in the first place. An example is urban development based on short distances between housing, work, and recreational areas.

Democratic innovation. Transition is not only about framing the transition challenge and making decisions about what to do, but it is also about reframing how processes are organized and their quality. A key will probably be to involve citizens, civil society, businesses, and other important stakeholders in open, co-creation processes.

Municipalities as catalysts for transition. Transition to a low emission society does not primarily require new knowledge, new regulation, or improved technology. Most important for local and regional authorities is to use their legitimacy as democratic actors in order to stimulate climate innovation processes. Municipalities should therefore primarily take the role as facilitator in order to strengthen collaboration across established sectors, administrative levels, and relevant stakeholder groups. Thus, municipalities can be a catalyst for change and transition. Political leadership will probably be the most important for exploring the potentials related to the municipality's different roles and functions. Municipalities should therefore combine basic local government functions, their roles as service providers, the development and management of infrastructure, and their ownership of enterprises as part of an integrated process of catalysing transition.

Strategic platform. Municipalities are encouraged to establish a political framework (strategic platform), which outlines local ambitions and principles for the transition process. Such a platform may well be very rough, but far more important is that the strategic platform is based upon local knowledge of challenges as well as possibilities. Such a framework can also address locally considered dilemmas and possible conflicts in the transition process. It is therefore hardly sufficient to develop "low emissions plans" without ensuring the processes needed to achieve change in practice. On the contrary, transition should first and foremost be seen as inclusive processes of exploration. In this respect a "plan", regardless of how well it is designed, can hamper such an approach.

Municipal sector as partner for national authorities. The municipal sector should continue and strengthen the dialogue with national authorities in order to develop more extensive strategic programs for transition to a low emission society. Such an approach can be decisive in stimulating new and more innovative local and regional interventions. The following suggestions, which are not exhaustive, should be a point of departure for a dialogue directed toward more comprehensive and integrated transition programs.

1. Conclusions and recommendations

This report has been directed towards illuminating the following main issues (and sub-issues) connected to the municipal sector's work with transition to a low emission society::

- Image of the challenge and understanding of the context
- Strategies and interventions that are important for realizing transition
- Need for institutionalization
- Recommendations for further work

1.1 Image of the challenge

What characterizes a low-emissions society?

- Emissions would correspond to 1-2 tonnes per resident. This means that a reduction in greenhouse gas emissions of 80 to 90 percent.
- The economy would be based on a circuit principle (circular economy) and shared solutions. This is characterized by finding common solutions to a larger degree, and better utilizing resources and capacities, for example within transport and construction.
- The municipalities would have institutionalized their work with the environment and climate, and it is thus not dependent upon any individual's engagement.
- Local societal- and regional- development would be based on a dialogue and collaboration-driven innovation where different administration levels, residents, and businesses take part together.
- Diverse schemes would be established to ensure funding for the municipal sector's climate work.

Which challenges for planning- and governance systems in the municipal sector come about due to the transition in a short time perspective (15 years)?

- Within a 15-year perspective, emissions will likely need to be reduced by around 50%. This would contribute a foundation for reaching a target of 80-90 percent emissions reduction by 2050.
- There is an underlying distinction of three intervention levels. Level I: Improving efficiency within today's structure and system-thinking. Level II: Development in how activities are performed and tasks are solved, moderate system changes. Level III: Transition, prevention, and system changes. Interventions at level I can hardly reduce emissions more than 20 to 30%. Interventions at level II and III should therefore also be further developed moving towards 2030.
- Interventions at level I likely mean few changes for the planning- and governance- system and can largely happen already, within established areas of responsibility.
- At level II, and especially at level III, there is a lesser degree of common answers regarding which transition interventions to realize. This means that the planning- and governance systems are challenged by the need for an increasing degree of cooperation and multi-level governance, which is necessary to secure adequate dynamics in, and institutionalization of, the transition work.
- Transition at level II, and to in particular at level III, will require the municipal planning- and governance systems be supplemented with processes that are dynamic and based on collaboration-driven innovation.
- The municipalities' role will then, to a greater degree, be stimulating engagement and broad participation, and developing their role as catalyst for transition in each local society and region.
- To a greater degree, local political leadership will thereby be required to decide which questions should be set on the agenda in the transition work, and ensure that administrative leadership facilitates that the municipality takes a broadened and new leadership role in the transition work. The development of strategic, population-elected leadership will therefore become relatively more important in relation to traditional objective-and-result steering.
- The transition processes entails that follow-up of political results need to increase their focus upon societal effects (for example, following up of the overall emissions from each local society or region), and to develop robust indicators..

1.2 Strategies and interventions

What will be the most important transition interventions?

- The transition work should be primarily focused on each individual municipality and region implementing interventions that are suitable for their local and regional context, and which have political anchoring both locally and regionally..
- At both the municipal and regional levels, the focus upon concrete interventions and solutions should be supplemented with the development of a strategic basis containing principles, guidelines, and visions.
- There is a need for projects (area development, larger construction projects, transportation, municipal services, etc) to build to a larger extent upon strategic concepts, such as "win-win" solutions ensured by implementation.
- The transition interventions should be sought after whether or not the emissions happen locally or in connection with activity, consumption, or production beyond municipal borders. Indirect emissions related to a municipality's residents and businesses, should be addressed in addition to the municipality's own enterprises.
- The themes of construction, transportation, and food will be good entry points for developing local and regional strategies. A significant part of greenhouse gas emissions are connected (directly or indirectly) to these themes. They can be affected locally and are relevant themes for residents along with local businesses and other community actors.

  · Transportation leads to direct emissions in the municipality and indirect emissions through driving outside of the municipality, along with the emissions from the production and distribution of both vehicles and fuel..

  · Construction leads to direct emissions through heating and construction, from transportation to and from the building both during construction and operationally, along with indirect emissions connected to the materials that are used and the purchase of energy (fuels, remote heat, electricity, etc.).

  · Food can be connected to emissions from cultivation and production processes, further processing and preparation, and transportation in all steps. The emissions are distributed both as direct and indirect emissions.

In which ways do transition interventions distinguish themselves from today's climate initiatives?

- Many of today's climate initiatives happen at a level which requires little change in consumption- and production patterns. In the worst case, these types of initiatives can contribute to reducing the attention on the need to change structures and institutions.
- The most important difference between today's strategies and initiatives is that within a transition process, there is a need to address new and more fundamental problems. This demands a more open and innovative approach, and an increasing the priority of broad participation and partnerships.
- An important difference will likely be that it becomes more difficult and less reasonable to discuss concrete interventions (solutions) and there will be a need to develop an understanding of the room for possibilities connected to developing and realizing innovative strategic concepts. An example here is the need to develop new business concepts for sustainable transportation, which enable coordination with other processes in urban development and place-making.
- Transition interventions will, to a greater degree, require that conflicting goals are handled and transformed to win-win solutions, for example through developing low emission solutions during construction in areas with multiple landowners and developers.

Which conflicting goals are involved in the transition to a low-emissions society?

- The basic conflicting goals (particularly in the short-term) include the consideration of short-term economic profits vs. establishing structures that lay a foundation for transition and long-term effects. This can breed conflicting goals between:
- Local benefits for the municipality/local society vs. transition that is motivated from the consideration of what is best for the common (global).
- Short-term need for jobs vs. the necessity to invest in businesses that have a development potential (including export of goods and

services) in the longer term.

- Land owners/developer's desires to build in areas that are outside of defined urban centres, vs. the consideration for climate-friendly area, housing, and transportation planning.
- The desire for transit node development with high density vs. ensuring other qualities, for example blue-green infrastructure and the preservation of existing residential qualities.
- Land preservation vs. densification in areas near urban centres.
- Climate-adaptation considerations vs. interventions for reducing emissions, for example in areas suited for densification, but threatened by rising sea levels.
- Law-regulated tasks vs. local "voluntary" political climate priorities, especially when these do not have national financing. This goes along with the wide breadth of municipal tasks and municipality's expectations in a great many areas.

What will be the most significant hindrance to reaching the necessary transition?

The main challenge in the transition to a low-emissions society is hardly lacks of knowledge, of technology, or of resources, but rather initiating, anchoring, and developing innovative processes and conversations of high quality. It is, however, demanding to address new issues (especially at level III), and connect them to developing municipal roles as societal actors. The central hindrances are:

- Limited competence and capacity in the municipalities for them to be able to function as catalysts for collaboration-driven innovation, and through that, to take on the role as a (the) leading actor in the transition to a low-emissions society.
- Lacking or weak connections between municipal innovation work and the transition to a low-emissions society. This limits the possibilities for working systematically towards handling conflicting goals, and thus through realizing win-win solutions.
- Limited coordination between the municipalities' different roles and areas of responsibility, which again limits the potential for developing and anchoring new solutions.
- Insufficient institutionalization of transition work – locally, regionally, and in interactions between administrative levels. This also means that transition work is, to a limited degree, integrated in the municipalities' organization, strategies, and priorities.
- Obscurity in what the national government expects of the municipalities when it comes to transition work. This is also connected to weak national economic incentives for transition.
- The lack of measurement and evaluation of climate policy objective achievements, connected to local and regional limitations in statistics, measurement tools, and indicator development.

Within which time perspective must the transition interventions be implemented?

- In order to reach the objective of low-emissions municipalities in 2050, it is important that the transition work starts immediately.
- For interventions at level I, the focus should be on accelerated, and largely more coordinated, implementations in the municipal sector. This is a relatively noncontroversial measure, and can strengthen development processes (interventions at level II) as well as a more fundamental transition (level III).
- It should be immediately discussed how transition to a low-emissions society can contribute to also realizing other important societal objectives (win-win interventions), for example green business development, positive health effects, and climate change adaptation.
- Interventions at level III are considered necessary to implement and realize a low-emissions society, as well as to maintain it in the long-term.
- The interventions that are chosen must be suited to the local context, i.e. place characteristics and local acceptance of the interventions.

In which order should the interventions be implemented?

- The order of the interventions will depend upon local and regional contexts. At the same time, it will be important to establish a strategic platform, which includes interventions at levels I, II, and III.
- Even if the implementation of measures at level III can only first be implemented in the long term, the work towards developing strategies for level III should happen in parallel with interventions at levels I and II, and within the frame of a local and/or regional strategic platform.
- Interventions that "lock in" municipalities should be identified as quickly as possible and avoided (i.e. that the transition work and more radical interventions later will be more difficult to realize), for example stalling work until new areas can be used and/or considering whether

the need for new infrastructure can be solved in more climate-efficient manners (concepts).

- In the strategic platform, priorities in the short-term should lie within ensuring appropriate institutionalization is directed towards the transition to a low-emissions society. (Programs, projects, enterprise establishment, agreements, financing solutions, foundation for innovative public procurement, etc)..

How should climate-adaptation interventions be coordinated with the transition work?

- Strategies and projects (especially) connected to area development, infrastructure, and larger construction should be prioritized to ensure the most possible qualities and effects (win-win solutions). This means, among other things, that solutions should ensure climate change adaptation, in addition to contributing to the transition to a low-emissions society. For example, solutions that reduce the amount of stormwater can simultaneously exploit stormwater to other uses (i.e. recreational use).

1.3 Consequences and assumptions

What will the goal of transition mean for the municipal sector?

- The transition to a low-emissions society and a more climate-friendly society includes potential gains (win-win solutions), as well as challenges and short-term negative consequences. Examples of the gains are connected to economic savings through solutions that demand less resources and solutions that give increased objective achievements (see for example Aasen et al, 2015). This can include health gains through increased bicycling and walking, for example, along with reduced pollution in urban centres, new business developments, and more.
- The short-term negative consequences are connected to conflicting goals in the short term (see Chapter 1.2), and reduced income and/or increased costs. These can happen, for example, through replacing the construction of new areas, infrastructure, and buildings (housing, recreation, business, etc) with densification and transformation in existing urban centres. This can comprise stricter practices in area planning in order to focus more on construction around transit nodes and the adoption of restrictive measures like parking restrictions and high parking fees that contribute to the incentives that a climate-friendly lifestyle offers.
- Transition means potentially increased levels of conflict and local protests – for example against construction projects.

Which conditions must be in place before the municipal sector can contribute to a low-emissions society?

- Transition to a low-emissions society demands increasing the priority of institutionalization. This is connected to processes and working forms, structures, and resources, all of which can be used in the transition work. Such changes are necessary to ensure both new thinking (ideas, concepts, and design) and implementation.
- The municipalities should develop their roles as societal actors to a greater degree. This includes prioritizing adequate resources (or increasing the resources), as will be necessary to ensure adequate approval of, and participation from, large parts of the local population and local business actors.
- The scope of the challenges of transition suggest that there is a need to develop and implement programs and initiatives that will demand considerable national funding.
- There is a need to institutionalize the transition work locally, regionally, and nationally – and tie this to initiatives that involve multiple administrative levels and/or other societal actors.
- It will be especially important to build a foundation for the municipal sector to become a leading transition actor by being a catalyst for transition.

How can transition interventions in the municipal sector contribute to necessary changes in other societal areas, for example in local business development?

The transition to a low-emissions society has many inherent possibilities for shaping local business development. In the title of this report, "local quality", lies the notion of exploiting local resources and advantages, among other things. The climate challenge can be connected to local advantages through, for example, exploiting the potentials within local resources such as wood, soil, and forest, along with human resources in the form of initiative-rich groups and people. Transition can also mean a need for increased quality in cities and villages, and through that foundation can be laid for increasing the quality of life and local business enterprises.

1.4 Recommendations for further work

The municipal sector as a leading transition actor

It is recommended as a starting point for further work that the municipal sector has a potential to become a leading actor in the transition to a low-emissions society. In order to develop that role, it is recommended that the municipal sector work further through the following main processes:

- Common basis for the municipal sector's transition work
- Local processes
- Regional strategies
- Development of collaboration with the state
- Network and experience exchange

Common basis for the municipal sector's transition work

It is recommended that the municipal sector begins with the following principles to further develop roles as transition actors:

- Local quality as a starting point for the transition work
- The municipalities as catalysts for collaboration-driven innovation
- Strengthened local and regional political leadership
- Anchoring in the municipal sector
- International collaboration

Local Quality

Norwegian municipalities are considered to have a significant potential for innovation and transition through developing local competencies and social capital. The starting point for the transition to a low-emissions society is local society's qualities - those connected to natural, cultural, or social preconditions.

This also includes the further development of participation in national and international networks, so that this does not become a strategy for isolation. At the same time, such a strategy should be directed towards strengthening and further developing local and regional value creation and innovation, including making use of the technological potentials that the transition to a low-emissions society will build upon.

For example, this will apply to the use of IT and smart solutions in order to make new solutions possible within transportation, construction, and food production.

With this starting point, it is recommended that "local quality" is used to denote the municipal sector's common principles for the transition to a low-emissions society. It is recommended that the municipal sector begins with the following principles in the transition to a low-emissions society:

- **Start with the goal of local society with quality**: Municipal development should be directed towards the quality of life when it comes to content (quality in residential environments, local businesses and organizations, etc.) and process (including the qualities of trust, openness, participation, etc.). The low-emissions society is not regarded as an objective in itself, but as a necessary adaptation to a new and dramatically changed context.
- **Think globally, but trade both locally and globally:** This means that the overall greenhouse gas emissions (direct and indirect) from residents, businesses, and the municipality's own enterprises are taken into account in the transition work.
- **Exploit local qualities:** Prioritize the potentials for local quality to be recognized and exploited, and that "locally-sourced" is sought after as a starting point within work, housing, shopping, activity, entertainment, etc. This approach will, to a larger degree, facilitate local life-cycle solutions with optimized use of resources.
- **Develop communal solutions and sharing:** Communal solutions strengthen the potential to develop and realize multiple objectives simultaneously (win-win).

The municipalities as catalysts for cooperation-driven innovation

As leading transition actors for a low-emissions society, it is recommended that the municipalities become catalysts for local processes (organizer or facilitator for value creation). This means that the municipality utilizes its legitimacy as a societal actor and works actively to organize processes that build upon the diversity of competence that is found both within and outside of each local society and region. As transition actors, it is recommended that the municipalities engage all their own enterprises to take initiative and hold responsibility over implementations within their own enterprise, optionally in collaboration with other actors.

Local- and regional political leadership

It is recommended that the transition to a low-emissions society be seen as a challenge and

possibility for further developing local- and regional political leadership roles. Putting fundamental challenges on the political agenda, securing processes for democratic participation, and including partnerships (open, and preferably critical to norms, innovation) should be prioritized. Developing new collaboration models is recommended within the frames of a representative democracy.

Anchoring in the municipal sector

It is recommended that the transition to a low-emissions society become a theme that is actively discussed in KS common forums. A starting point can be creating a process directed towards KS's national board's handling, which again can facilitate a process towards its national meeting in 2020. In addition, KS is recommended to take an active role in stimulating and/or facilitating local and regional processes, including assessing the need for a municipal network for the transition to a low-emissions society.

International cooperation

It is recommended that KS, with consultation from relevant stakeholders and persons, attempts to answer concretely how Norwegian municipalities and regions can take part in, and come together to develop, international municipal collaborations regarding transitioning to a low-emissions society.

Local processes

The most important part of the transition work will be the processes within each municipality and region. Local transition work should begin by establishing an understanding for why the transition to a low-emissions society is important, and for how each local community relates to the transition. It is therefore recommended that all municipalities create processes directed towards establishing a strategic platform for the transition work, which should have the municipal council's active involvement and ownership. The platform should be directed towards giving political guidelines, both for the work in the local society and for how the municipality as an organization and as a community should orient itself to the low-emissions challenge. In building such a platform, it is natural to form a process with external stakeholders, the municipality's own enterprises, and residents.

Each municipality should cautiously hasten to prioritize anchoring and quality in processes connected to the transition work. At the same time, this should not restrict the planning and implementation of parallel climate initiatives, especially if they do not "lock-in" the municipality, or restrict their room to manoeuvre. It is recommended that each municipality facilitate a running organizational adaptation (institutionalization) for the transition work. For the municipalities, this means that, among other things, organizational and leadership development should be directed towards taking an active role in the local transition work. This will become significant for structuring municipal enterprises - those over core areas of permanent responsibility and those over projects, programs, and networks, along with freestanding departments, companies, and networks. At the same time, there will be a need for competence in working with complex and interdisciplinary issues, something that should be mirrored in the municipality's strategy for developing competences.

Regional strategies In consideration of the process of structuring new regions, it is recommended that KS establish its own project to make concrete how the new regions can be actors that promote the transition to a low-emissions society. The project would be directed towards establishing a common starting point for the new regions, which gives each a basis for optimizing its role and clarify which themes it should prioritize. The project can also make concrete the national parliament's expectations when it comes to conditions, competences, and the transfer of tasks from the national level to "low-emissions regions."

Development of collaboration with the state

A further development of the dialogue between the municipal sector and the state is recommended. This dialogue should be oriented towards identifying common challenges and collaboration potentials in the transition to a low-emissions society..

Since the transition can be considered a wicked problem, it is recommended that this dialogue be started by discussing principles and identifying priorities and interventions. At the same time, such a dialogue should be directed towards establishing and financing initiatives within areas that have a potential for transition, and for realizing win-win solutions.

The themes that should be considered as particularly relevant to address here are:

- Collaboration in interventions should be considered important to implement in as many municipalities as possible, especially in instances where it is important to secure accelerated and coordinated implementations (for example in level I interventions).
- Potentials to strengthen the transition work should be connected to establishing new municipal and regional structures.
- The development of research- and innovation policies should be directed towards stimulating the municipalities to catalyse collaboration-driven innovation, including their establishment of strategic partnerships/networks in areas of particular importance. The development of innovative public procurements can also be included in such collaborations.
- How the municipalities can contribute to promoting a circular- and collaborative-economy, and through that, actively contribute to the green shift.
- How area and transportation politics can be further developed in a manner that promotes transition to a low-emissions society and simultaneously offers a foundation for win-win solutions.
- How the national Planning and Building Act (PBA) can be developed as an instrument for transition to a low-emissions society, and an overall sustainable development.
- How a foundation (measurement, data basis, indicators, etc.) for local and regional transition work results follow-up should be developed.
- The localization and conceptual development of larger public construction projects should be rethought.

2. Methods

The transition to a low-emissions society is a challenge of a character that demands a suited methodical approach. Different information sources (theory, informants, dialogue with the contracting entity, case study, ideas, development trends, etc.) were chosen in an interactive process through the work on this report. Both a quantitative and a qualitative approach are used. This approach offered a broad basis for interpretation and reflection. The report came to be through a process of interpretation and analysis, where dialogue with the contracting entity was important.

A reflective (interpretive) and processual approach was assumed. As Figure 2-1 shows, this consisted of a process which prioritized a comprehensive perspective while making use of concrete examples, cases, and ideas. Together this contributed to the report's overall understanding

Semi-structured interviews were held with resource people that have experience from the municipal sector, national sector, research- and academic milieus, and business life. The interview guide, overview of informants, and a summary of their input is contained in Appendices 5 and 6 of the Norwegian version of this report. As the figure above shows, dialogue with the informants became part of the foundation for the report's evaluations and recommendations. Which input each informant gave is not included directly in the text.

Multiple examples have been used in the analysis, and it was chosen to use examples from contexts that are considered relevant for Norwegian municipalities. The resulting Norwegian and European examples were chosen by those easiest to relate to Norwegian municipalities.

None of the examples should be considered as beacons or perfect prototypes when it comes to transition. Neither do any of them illustrate a complete climate transition in a municipality. Several examples have clear weaknesses, which were used to illustrate important potentials for improvement. Other examples were not specifically directed towards a low-emissions society, but were chosen because they have principles and experiences that can be considered important to the transition to a low-emissions society.

A consistent trait through the examples that have been used is that they show aspects and experiences which Norwegian municipalities can consider as inspirational in their further work with interventions and/or processes in the transition to a low-emissions society..

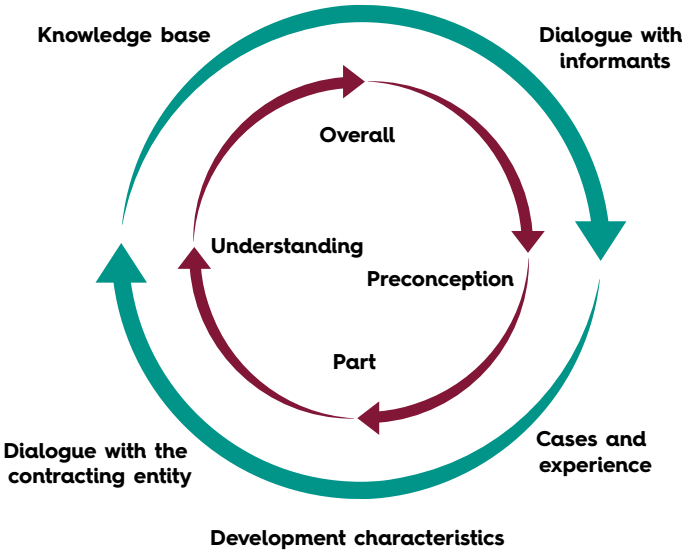


Figure 2-1: The report's methodical approach that prioritized the use of different information sources (outer circle), together with a process where a comprehensive understanding and concrete elements (parts) gradually contribute to an overall understanding. This understanding of low-emissions society formed the basis of this report. Based on Alvesson and Skjoldberg (2007).

3. Low-emissions society

3.1 The Climate Challenge

Through the climate agreement from Paris in 2015 and the national climate agreement, a broad consensus regarding Norway's need to transition to a low-emissions society has been established. The analyses performed by the Norwegian Environment Agency (2015) show that it is possible to reduce national emissions to a level equivalent to 1-2 tonnes per resident in 2050, i.e. the level that is defined as a low-emissions society. This means a reduction of 80-90% of current emissions by 2050.

The UN's climate panel defines transformation as: "The altering of fundamental attributes of a system, including value systems; regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems. (IPCC, 2012).

This means that the challenge of transition which international society faces is far more fundamental than giving environmental considerations increased priority. The challenge points in the direction of requiring a broad societal innovation process that encompasses business life, the public sector, volunteer organizations, and individual residents.

3.2 Norway's and the municipalities' greenhouse gas emissions

Direct emissions

Norway's greenhouse gas emissions

Sectoral analyses show that it will be possible to reduce direct emissions nationally down a level equivalent of 1-2 tonnes per resident in 2050 (Miljødirektoratet - Norwegian Environment Agency 2015). The scenario builds upon an investigation of 84 assembled greenhouse gas emissions-reducing interventions. The interventions are divided into three packages with reduction potentials up to 2030. Each package is linked to costs and assessments of how demanding the interventions will be to implement. The intervention list exhausts neither potential greenhouse gas-reducing interventions or potential variations of intervention packages. In Figure 3-1, the target for 2050 is represented as an emissions level equivalent to 1.5 tonnes per resident, given a projected population in Norway of 6.6 million.

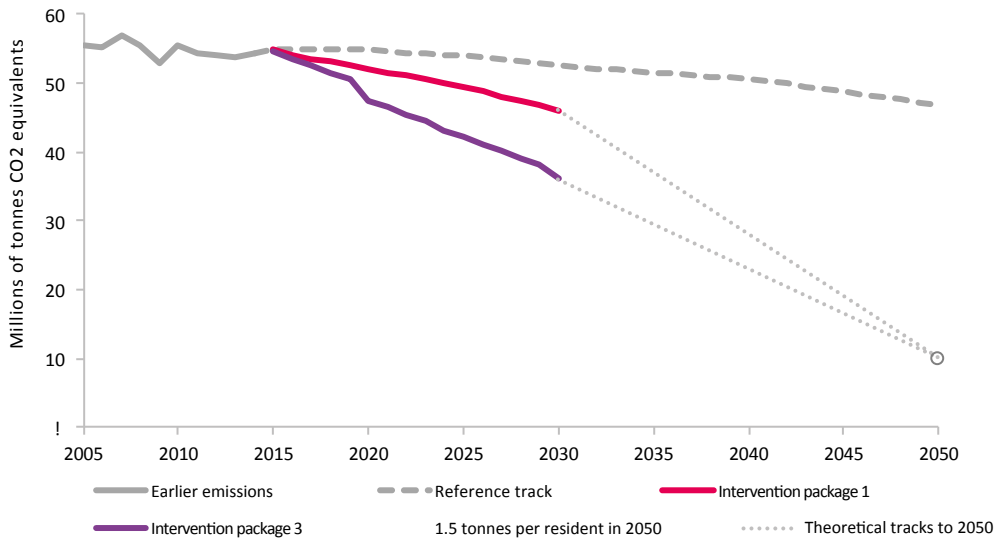


Figure 3-1: Emissions tracks towards 2050. The grey lines from 2030-2050 illustrate the emissions cuts necessary during the time period in order to reach a level of 1.5 tonnes per resident. Source: The Norwegian Environment Agency..

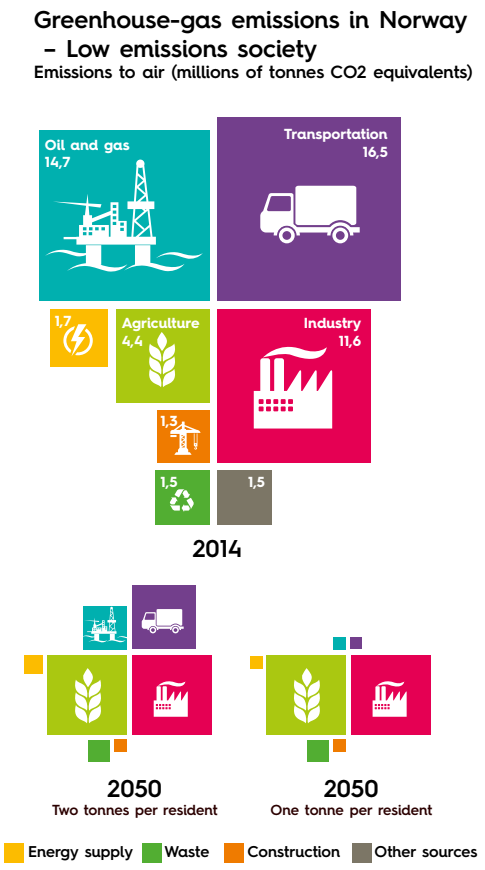


Figure 3-2: Emissions distribution by sector for Norway, today and with two emissions levels targeted in 2050 (respectively equivalent to 2 and 1 tonne CO2 eq. per resident – i.e. the level defined as low-emissions society).

Figure 3-2 above illustrates the distribution of Norwegian greenhouse-gas emissions by sector in 2014, with two emissions levels in 2050. The remaining emissions in 2050 correspond to 1-2 tonnes per person and will largely be connected to agriculture and industry.

A low-emissions development will affect all activity within Norway, including the municipal sector, how the municipalities perform, and how their enterprises and residents are facilitated. The interaction between municipalities, regions, the state, and international levels will be affected as well. Both the Low-emissions Committee and the Norwegian Environment Agency propose interventions which to a large extent affect activities administered and shaped by the municipalities, such as localization, densification, combined land area and transportation planning, energy solutions for buildings, public transportation, and walking/bicycling.

At the same time, the national investigations lack assessing the potential for reducing emissions locally and how juridical- and financial means can be facilitated by local government for the greatest effects. Seen together, the national government has created an expectation that the municipal sector should contribute, although they offer few real incentives or concrete guidelines for doing so.

Municipally-distributed greenhouse gas emissions

Around 40 percent of the total greenhouse gas emissions from Norwegian territories are distributed over the country's 428 municipalities. Emissions that are not possible to place by municipality are emissions from oil- and gas extraction offshore, flight traffic/airspaces, and sea areas. In addition, there are a series of sources omitted due to a lack of sufficient information to place the emissions regionally or by municipality - this applies to shipping traffic along the coast and the use of products that give off fluorogas emissions.

The municipally-distributed emissions include the greenhouse gases carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), and are distributed by seven sources that are listed in Figure 3-3. These emissions are direct emissions within the municipalities' geographically defined borders.

In a review of applicable climate- and energy plans, Vista Analyse (2014) shows that the municipalities have proposed interventions and means within most emissions sources and sectors, but have prioritized their own enterprises. The initiatives are primarily focused on reducing direct emissions and energy use, connected to direct emissions calculations and projections. The plans have little approached the ambition of developing a low-emissions society within 2030-2050.

The distribution of emissions sources in the municipalities indicates that attention from the municipalities' side should be directed towards mobile sources (road traffic, motor vehicles[1], agriculture, and industry). The municipalities' (and Norway's) indirect emissions and carbon footprints result from the consumption of goods and services that are imported or produced in another land, and have not been included in the Norwegian Environment Agency's or SSB's numbers for municipal- and county- distributed direct emissions.

1 The definition of motor vehicle: "Mobile machines/self-driving work vehicles, which have wheels and/or belts where the machine or vehicle's basic construction is distinguished from other motor vehicles for transport of goods or people, or tractors." Source: Vehicle Regulations (Kjøretøyforskriften)

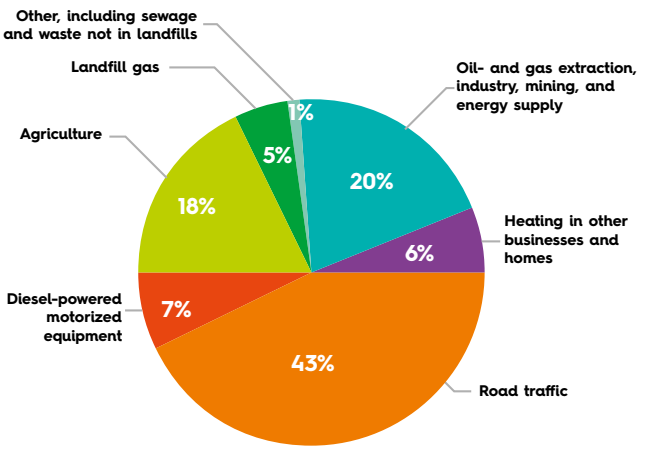


Figure 3-3: Municipally-distributed emissions levels for 2013 (direct emissions) which make up about 40 percent of Norway's entire territorial emissions. Source: SSB-note 2016-04.

Indirect emissions

Basing the distribution of emissions sources and evaluations of possible interventions upon a perspective of indirect emissions turns the attention and priorities towards other products and activity areas. The difference in the approach is illustrated in Figure 3-4, where system delineation for direct emissions is given as a "geographic perspective," and indirect emissions are denoted as "carbon footprint." The latter also depicts a life-cycle perspective to calculating emissions.

Direct emissions, the geographical perspective, includes only the emissions that physically happen within a geographically bounded area, i.e. a nation, a municipality, a city.

Indirect emissions, carbon footprints (the life-cycle perspective) includes the greenhouse gas emissions that can be connected to a product no matter where the emissions happen geographically. Such a footprint calculation includes the extraction of raw materials, their transportation, their processing into a product/ good, the distribution of that product to the actor or person who will utilize it, and the product's treatment as waste..

As figure 3.4 illustrates, in a consumption-based carbon footprint (life-cycle perspective), industrial emissions would be excluded in the instances where the industry exports goods out. The emissions from industrial production would be distributed to the geographical area where the consumer of the goods/ services lives. Accordingly, accountability for local transportation emissions would not be included in instances of through-traffic or when commutes are travelled by residents who live outside of the municipality. .

Life-cycle perspective in the transition work

In an emissions calculation based on indirect emissions, a product's emissions are allocated to the actor/person who buys and uses the product. For the municipality as a business, an indirect emissions calculation would include emissions connected to all procurement of goods and services utilized by the municipality, not only the direct emissions from driving owned vehicles and heating owned buildings with oil cellars, for example.

Such an approach changes the meaning and prioritization of different interventions in many cases. Both direct and indirect emissions should therefore be included when strategies for a low-emissions society are made. If not, the result can be an emissions reduction in one nation, municipality, or enterprise, but a net increase in total contribution to global emissions.

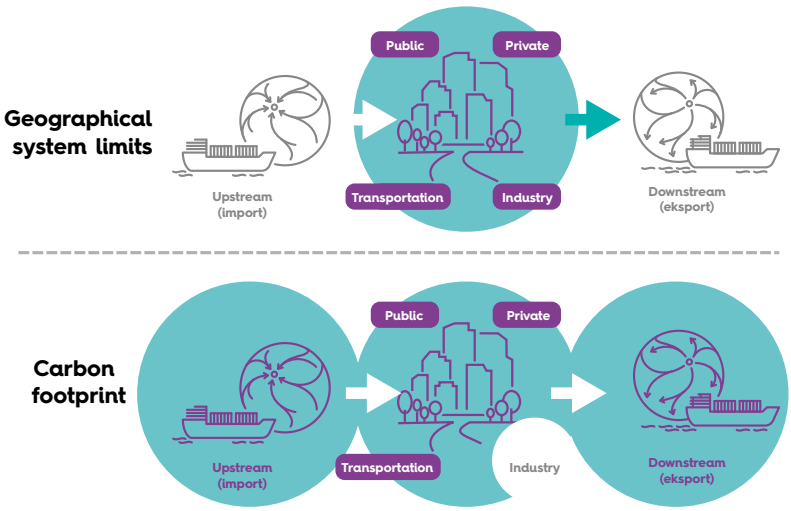


Figure 3-4: Illustration of the system delineation for calculating direct (geographical/territorial emissions) and indirect emissions (carbon footprint/life-cycle perspective). Source: Hogne Nersund Larsen et al./ Energy Procedia 20 (2012) 354-363.

Emissions distribution in Lærdal municipality

An example from Lærdal municipality. The figure to the right shows the difference in emissions distributions by source when indirect emissions are included. The figure shows known shares of emissions based on what happens within the municipality's boarders (purple columns), and shares of emissions that happen outside of the municipality's borders, but which are caused by activity in the municipality (red columns). Here all enterprises and the population's contribution are included.

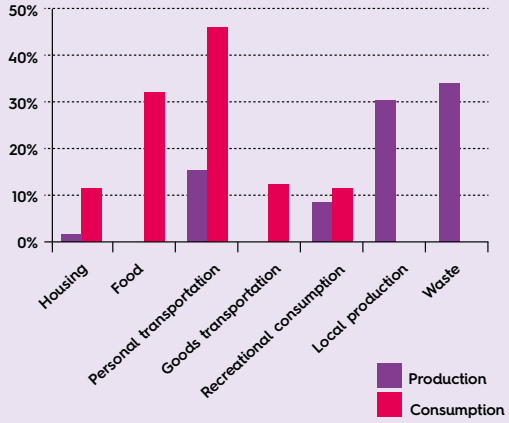


Figure 3-5: Emissions in Lærdal municipality distributed over consumption categories. Source: Vestlandsforskning

The Norwegian Environment Agency's illustrations of the Norwegian low-emissions society in Figures 3-2 and 3-3 thereby give an inadequate picture of the relationship between emissions sources and effects, as well as of the interventions and intervention packages that should be prioritized. The emissions calculations include only direct emissions within the country's borders (geographical perspective), not the indirect emissions (footprint- or life-cycle perspective).

The Norwegian Environment Agency's analyses therefore do not highlight the total contribution to global emissions from Norway's population, Norwegian municipalities, Norwegian industry, or other activities that happen on Norwegian territory. The significance of this lack is illustrated through examples from two Norwegian municipalities in the following section, where both direct and indirect greenhouse gas emissions are taken into consideration..

The examples from Lærdal and Oslo municipalities illustrate that an emissions calculation that includes indirect emissions can give a completely different perspective and prioritization of emissions-reducing interventions in each municipality. For a transition to a low-emissions society, i.e. where the global emissions level is only 1-2 tonnes per person per year, the indirect emissions must be given increased attention in the design of strategies and evaluation of interventions. The life-cycle perspective should be used as a basis.

Emissions contribution from Oslo municipality's enterprises

The calculations of emissions contributions from Oslo municipality's enterprises show how different the picture becomes when the approach includes indirect emissions. Only three percent of Oslo municipality's carbon footprint comes from direct emissions in municipal enterprises (Scope 1), but 97 percent of the emissions derive from other enterprises connected to Oslo municipality's consumption of energy (Scope 2), goods and other services that are imported from other parts of Norway (Scope 3 Norway), or from other lands (Scope 3 imports to Norway).

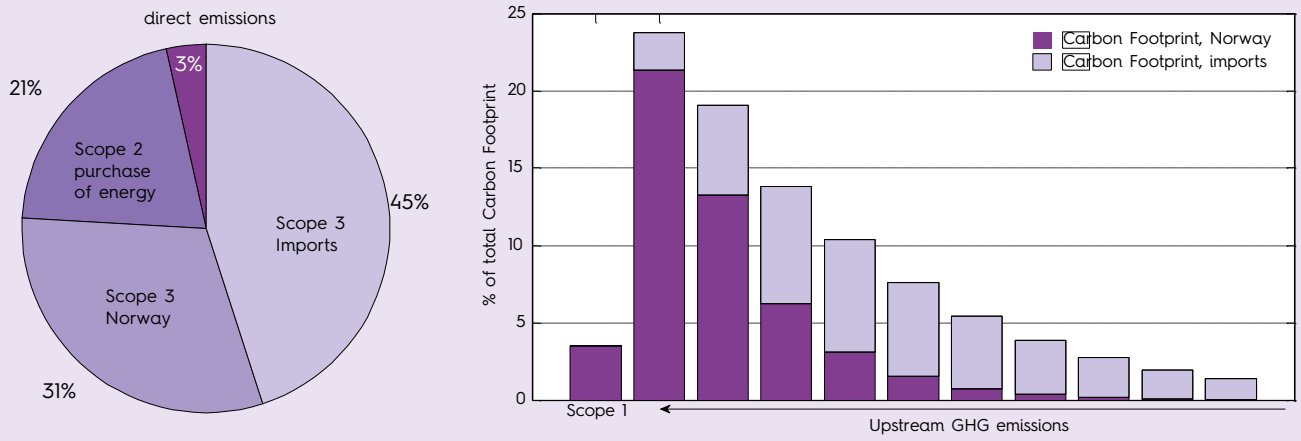


Figure 3-6: Classification of emissions in Oslo municipality as Scope 1, 2, and 3 emissions (figure on the left). Scope 1 is direct emissions, as from burning of oil in oil cellars, gas, and diesel in owned vehicles, etc. Scope 2 is emissions from the production and distribution of energy, including electricity. Scope 3 is emissions from the consumption of imported goods and services, i.e. where the emissions happen outside of Oslo municipality.

3.3 The municipal sector's climate work

Through international and national climate policy processes, the municipalities have become increasingly more central to transition work. The municipalities are recognized today as key actors and together as an independent political sphere in the work towards realizing a low-emissions society (see for example the Paris Agreement 2015).

Since the 1980s, Norwegian municipalities have taken an active role in the environment and climate work. This has happened through local initiatives and different collaboration programs with the state and other actors. The following main processes have been very central:

- Environmental protection in the municipalities and Local Agenda 21
- Vigorous Municipalities, Future Cities, and Green-energy municipalities
- Local and regional climate and energy planning
- Municipal plan strategies
- Development of the national Planning and Building Act in the direction of coordinated housing-, land area-, and transportation planning (national planning guidelines))

These show a significant potential for emissions reduction connected to local and regional processes. However, experience shows that there is still a clear division between visions and objectives regarding climate challenges within local and regional practices, particularly with implementation capacity. In general, we see that the goal of a low-emissions society does not align with the conditions posed by municipalities' land area regulation and detailed master plans – which rather open for too great a degree of development. For example, plans continue to allow construction outside of established transit nodes, and continue to maintain (or even expand) requirements for parking areas and –capacity.

The municipalities also have the potential for locally facilitating processes between different actors who can contribute to building up sustainable businesses and active local communities. Still only to a limited degree, have the municipalities developed strategies and processes that exploit their potentials for low-emissions solutions, for example in construction projects bridging school and care, housing and business.

The deviation between the municipalities' visions/objectives and practices/implementation capacity is strengthened by little specificity form the national level. The state has been limited in the degree to which they give guidelines and develop means for the municipalities to stimulate new thinking and innovation regarding climate interventions and implementation strategies. National strategies and conditions primarily continue with thought and management divided by traditional patterns and sectors. The Norwegian policies directed towards engaging the municipalities to take initiative with climate interventions have been neither clear nor continuous.

State support for local financing and positions that could boost local low-emissions development has been insufficient (for example see Kasa, Westskog, and Rose 2016). This gives a fragmented policy that does not promote innovative solutions or new collaboration forms. This hinders the state from stimulating the municipalities to make use of their local potentials in development.

In addition to emissions reductions, it is necessary to implement climate-adaptation interventions in order to handle the effects that anyway follow from a changed climate. However, the national work with low emissions society remains little coordinated - both among state's own work and with that of the municipal sector concerning climate adaptation.

Municipalities, counties, and regions[2] hold a particular place among Norwegian societal institutions when it comes to both holding the legitimization of and the human resources for initiating, facilitating, and leading development - and thereby for the transition work directed towards realizing a low emissions society. The municipal sector has an advantage when it comes to using an open and democratic approach to handle societal challenges. This indicates that the municipalities can better utilize their roles as societal actors to shape changes and initiate processes that lead to necessary change.

2 For simplicity's sake, this report uses "region" both as functional regions and as the new population-elected regions, see chapter 4.6 (Municipal and regional structure).

4. Main development trends

A strategy for realizing the low-emissions society must relate to the great range that exists within today's main development trends and societal challenges. The following themes are considered as particularly relevant for the municipal sector:

- Demography
- Social sustainability and public health
- Culture and values
- Transition of the Norwegian economy and industry
- Technology
- Municipality and region structure

4.1 Demography

By 2040, the population of Norway is expected to increase from 5.2 million residents in 2015 to 6.3 million by 2040. The population increase will largely happen in and around the largest cities according to the national statistic bureau's most likely alterative in the population projection (SSB, 2014). Almost 90 percent of today's Norwegian population lives in large, medium, or small city regions.

The demographic composition is changing – there is an increasingly aged part of the population. There will be fewer active workers for each retiree - the number of people over 70 years of age is expected to double in the next 30 years, and it is believed that every fifth person in Norway will be over 70 by 2060 (SSB 2014). Because of this increase in the aged, the need for health and care services in the municipalities will increase, simultaneous with an increase of competition for a competent workforce.

Population increase and growth of the larger cities and dense areas (increased urbanization) challenges the capacity of the transportation network and increases the pressure on available areas, among other things. A realization of the "zero-growth target"[3] in traffic depends on more concentrated and compact area developments, strengthened public transportation, bettered facilitation for bicycling and walking, and increased use of restrictive means against car traffic (NTP 2018-2029).

A development in the direction of compact city- and village development increases the level of tension in land area planning because interest conflicts increase (see Hofstad, et al. 2015 for a discussion about the challenges connected to compact urban development). For example, the pressure on central residential qualities offered by common outdoor areas will increase - including access to green infrastructure, air, and sunlight. The preservation of biodiversity, valuable natural ecosystems, and agricultural areas also becomes a central theme under pressure.

How the villages, cities, and urban regions function is significant for economic, social, and environmental development, which again become the central preconditions for realizing a low-emissions society. The municipal sector plays a central role in creating frameworks for the low-emissions society through regional and municipal land area and transportation plans.

4.2 Social sustainability and public health

How cities and places are planned and designed holds significance for local society's sustainability, social differences, and equality, as well as individuals' health. Health is affected by the conditions of an individual's everyday life, including the daily environment where they live, work, go to school, play, and entertain themselves. Physical cities/places are therefore significant parts of what set the conditions for residents' social lives. In the work towards the transition to a low-emissions society, the objective of emissions reductions should be seen in relation to social sustainability, both for reaching objectives in multiple areas at the same time and for maintaining a low-emissions society. In this relationship, the following themes are central:

- **Participation:** Participation creates active local communities and both anchors and legitimizes political decisions.
- **Qualities of the residential environment:** This can be access to green infrastructure, free meeting places like libraries, and a diverse housing structure. Residential environmental qualities are generally important for public health.
- **Transportation and accessibility:** Examples of this include good access to and between housing, jobs, schools, and preschools, along with access to public transportation services. These factors are crucial for attractive local societies.
- **Inclusion and diversity:** Examples of this are tolerance for different cultures, backgrounds and life philosophies, social inclusion, and equal possibilities. These relationships contribute positively to social sustainability.
- **Employment:** The localization and access to jobs is central for integrity, social meetings, and the maintenance of the quality of life.

Improved public health and the reduction of health-based social differences have been stated objectives for planning since the 2008 revision of the national Planning and Building Act. Municipal planning should "promote the population's health and counterwork health-based social differences while contributing to the prevention of crime" (translated from PBL §2-1f). The Public Health Act (2012) simultaneously requires that the municipalities set general objectives and strategies for public health work in their municipal plans. This integration of public health objectives into municipal planning offers a foundation for political prioritization in subsequent planning and in the actual development of areas.

3 The objective is that the increase of personal transportation in large city areas should be carried by public transportation, bicycling, and walking. Source: Klimaforliket (Norwegian Climate Committee), Chapter 4.1, and NTP 2018-2029.

Today's local communities are largely developed by private landowners and developers. The densification strategy is primarily grounded from the need to reduce land area- and transportation needs, and through that, reducing greenhouse gas emissions. Common goods often come under pressure when areas are densified, and the participation dimension is seldom upheld beyond the minimum requirements of the Planning and Building Act. For example, a survey conducted through the "Future Cities" programme shows that population density has increased in Norway's 13 largest cities, while access to play- and recreation areas and the natural terrain has decreased (Haagensen 2011).

A challenge for the municipalities moving forward will be ensuring a city- and village development that adds new qualities to the local communities that also work towards a low-emissions society. Promoting the health perspective and reducing social differences requires an operationalization of general objectives. At the same time, the public health policy holds a potential for innovation and creativity, for example within developing different residential concepts that simultaneously work toward a low-emissions society.

4.3 Culture and values

Prioritizing opinion-shaping activity can become more important in the transition to a low-emissions society. Porritt (2013) describes a vision for 2050 where the world is a dynamic and good place to live for the vast majority of humans. The focus is humanism and use of humans' capacity for making the world a better place for later generations. Established truths connected to economic growth and consumption are replaced by wishes to share and cooperate, along with the notion that one's own activity should contribute to a qualitatively good society.

Such a direction for development can strengthen the work by encouraging engagement in local development, from the fundamental needs for belonging, participating, cooperating, learning, and other opinion-shaping activities. Development can open for new types of industry where material growth is replaced by knowledge development and human development. For example, the competence within the humanities will become more important. A consequence of that can be that social status becomes more connected to one's contribution to shared solutions and taking a broader societal responsibility.

This reinforces the need for "humanistic" urban development and place-making, where solutions that do not promote qualitative goods for all groups (including, activating) is less acceptable. In such a perspective, a school for example can become the starting point for competence development and growth, both locally and, in combination with digital solutions, even globally.

4.4 Economy and business

Reflecting over the fundamental assumptions of ones' own perceptions and practices opens the possibility for different strategies within the transition to a low-emissions society. Today, the need for transition in industry is highly prioritized, questioning how Norway can become a leader in the development and implementation of sustainable solutions after oil (Innovasjon Norge 2016).

It can be important to have different perspectives regarding what gives desirable development. The following main current mind-sets can be used to open a critical dialogue:

- **Competition:** It currently prioritizes how one can develop goods and services for the global market through increased competitive power. The approach is often connected to establishing large-scale operations and increasing efficiency. Outside relationships (environment/climate) are external and it is important to secure that stricter requirements regarding emissions are upheld. Value-creation is primarily measured through financial results that "summarize the whole".
- **Collaboration:** It currently prioritizes that values are entirely shaped through cooperation. Through long-term relationships and trust, sustainable innovation can be developed. Nature and culture are integrated parts of economic activity and cannot be seen as external relationships. Value shaping is tied to the aggregated effects of enterprise (financial, environmental, cultural, and social) (Jakobsen 2016).

These two mind-sets can be seen as different ways to think (mental models). To start with, these might be seen as in conflict, where one solution must be chosen over the other. However, these two mind-sets can also offer a way to begin local dialogues regarding how competition and collaboration can be combined in each municipality. By being aware that more than one mind-set (one's own) exists, a positive starting point for dialogue can be established both about the mind-set and about good interventions can come from it.

The green shift

The Norwegian economy is in a downturn that began in the third quarter of 2014. The statistics bureau emphasizes that the drop in demand for petroleum enterprises, caused largely by the significant drop in oil price, is a dominating factor behind increased unemployment and lower income for the state. The future prognosis is uncertain, but the oil prices look like they will stay low in the long-term (SSB 2016).

The climate- and environment challenge demands transition to a society where growth and development happen within the limits of what nature can tolerate. Society has to come through what the government calls the green shift, which has become a term hoping to change the world.

Circular economy

In traditional economic approaches, natural resources and the environment are not included. The economy is seen as a linear model from production to wellbeing. That which we produce (P) goes to consumers (F) or to produce capital goods (K), which again can be utilized to produce consumer goods (F) in the future. Consumption brings wellbeing (V). This thinking is behind the national budgets for many lands. The model below shows the linear model::

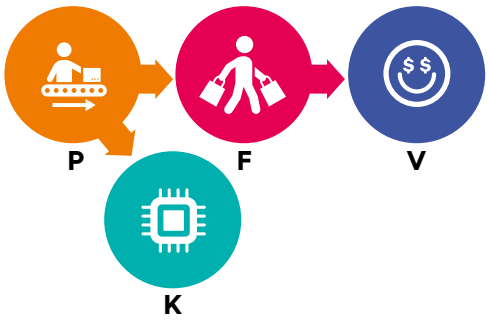


Figure 4-1: The linear economy

This manner of seeing the world does not harmonize well with what we know about the laws of physics. Through the first law of thermodynamics, we know that energy can never be lost; it only is converted into other forms. The amount of energy in an isolated system remains constant. The only external source of energy for the earth is the sun. Therefore, if we think of the earth as a spaceship (i.e. from Kenneth Boulding's 1966 book), it means that use of the spaceship's resources (i.e. earth's resources) will lead to a reduced length of life for the astronauts (i.e. humanity's length of life on the earth). The only way to avoid that is to recirculate the resources we have, a measure that gives a different picture of the economy than what we see in Figure 4-1. The economy becomes circular, not linear. This way of looking at economy is denoted as the circular economy..

Figure 4-2 illustrates the principles for the circular economy (Pearce and Turner 1993, page 40)[4].

In a circular economy, the natural resources are an input factor for both production and consumption. Natural resources are used directly for production, and therefore we have a line from natural resources to production in the figure. As consumers (individuals), we utilize nature for recreation and directly use its resources for our own consumption, as they provide us with wellbeing. Therefore, a line is drawn from natural resources to wellbeing in the figure, and this is positive since we enjoy the resources that nature provides.

Natural resources can be either renewable or non-renewable. If we use a non-renewable resource, it will lead to a reduction of our reserves of the resource. The extraction is always more than the reserve. This is indicated by the minus symbol in the figure. For renewable resources, the exact same situation occurs if we take out more than the resource can be replenished. However, if we take out less than is replenished, we will achieve a net positive gain in the renewable resource.

Both the extraction of natural resources, production activities, and consumption generate waste. Waste can either be recycled, or we have to depend on nature's capacity to decompose it (decomposition capacity). If we overload this capacity, there will be a negative contribution towards our wellbeing, as well as to the reserves of available natural resources. If, however, we do not overload nature's ability to rid itself of waste, we get a positive contribution to our well-being. This is marked in the figure with lines that go to natural resources and wellbeing, and are marked by either a minus or plus symbol, accordingly.

Circular thought gives large reduction of CO2. A calculation made by IVL (the Swedish institute for the environment) shows that in 2015, the second hand market in five European countries (including Finn.no in Norway) led to a reduction of 12,5 million tons of CO2 in the course of the year (Schibsted 2016). The EU has increased their focus on the circular economy. In December 2015, an action plan for the circular economy was released. The reduction and recovery of waste are important parts of the action plan, for example through supporting collection and recovery schemes and better date marking for food (EU 2015).

The circular economy can be tied to the sustainability discussion with the terms weak and strong sustainability.

4 D. Pearce and K. Turner's 1993 book gives an overview of the thought behind the circular economy. Ingebrigtsen and Jacobsen (2011) also address the theme.

With a circular thought as a base model for the economy and a strong understanding of the term sustainability, non-renewable resources cannot be utilized. Neither can renewable resources be used in amounts beyond their replenishment over time. This gives strict conditions for economic activity that many have challenged. Here enters the weak sustainability principle. If we presume it possible to substitute some of the natural resources with human-made capital, it becomes possible to recover non-renewable resources and take out more than is replenished of renewable resources (see Solow 1986 and 1993).

A strong sustainability principle often also has an ethical anchoring in non-anthropocentric ethics, i.e. where one considers that nature has its own intrinsic right to exist. There is also a fundamental question in the consideration of a weak or a strong sustainability principle, whether it is possible to substitute human-made capital with natural capital. This applies particularly if we take a long-term perspective and prioritize the future generations' right to inherit an equivalent natural capital to that of the current generation.

Shared economy

The shared economy, or that which is also called the collaborative economy, is a way to promote circular thought through the reuse and sharing of the resources we have - in a manner that several can utilize the same goods. A collaborative economy refers concretely to a situation where actors in an economy share the access to goods and services. Examples are car-sharing schemes, Airbnb, etc. The collaborative economy is not a new idea. In Norway, we find collaborative solutions in the tourist association's (DNT) cabin system, in voluntary work schemes (dugnad) in sports, and in sharing schemes in local communities. The difference now is that it has become easier to coordinate through internet-based solutions.

The collaborative economy has many forms – from sharing of goods and services to reuse and more life-style based systems where what one trades can become more elaborate. Here one can also trade "time," for example, as in exchanging grocery shopping for babysitting services. In some contexts, there have been currency systems developed for the sharing of goods and services. This is what is called LETS (local exchange trading system), where members can trade goods and services by using a local LETS currencies. Some eco-villages have their own currency systems for trading. An example of that exists at Findhorn, Scotland. Here they have a currency named "Eko," which aims to increase the local feelings of identity along with collaboration and sharing (see Findhorn Foundation 2016).

There are many examples of good collaborative economy concepts. An example from Denmark which has attracted some attention is the organization "Naboskab". Kristofer Ravnbøl, a Danish anthropology student, took the initiative to set up a sharing platform in a housing association in the form of a physical cabinet with shared goods like tools, sporting equipment, and films. All the neighbours have access to the cabinet through their own key.

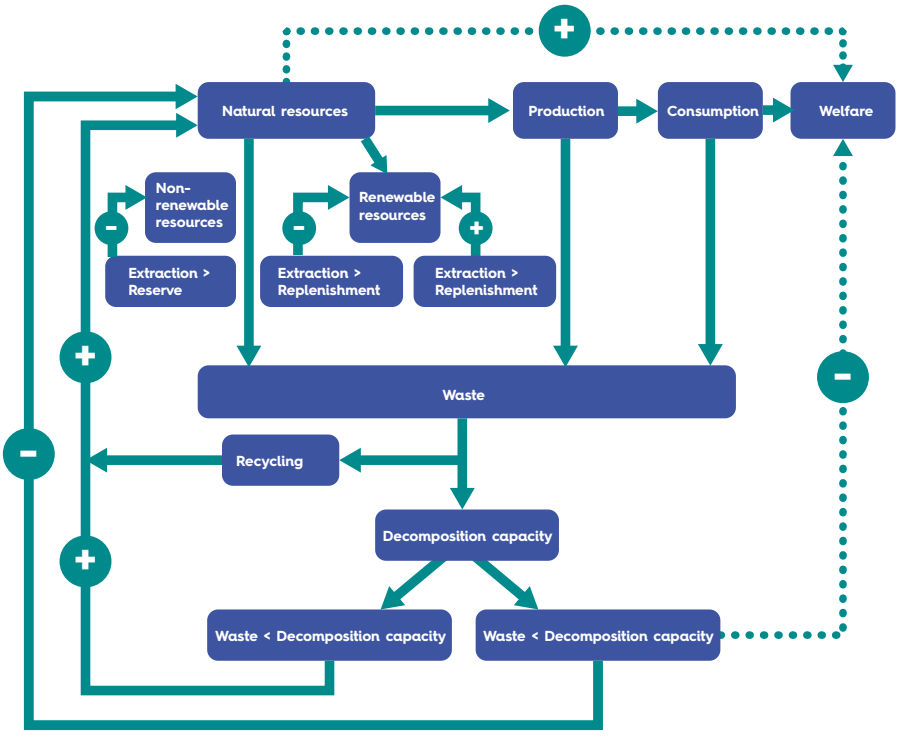


Figure 4-2: The circular economy/life cycle economy.

A significant precondition for this scheme's success is that participants are acquainted with and trust each other. The scheme also contributes to increasing social community. Here we see that, in addition to providing environmental solutions, collaborative schemes can give additional effects through inclusion in a community (see Pengevirke 2015).

Municipalities can contribute with facilitation of the collaborative economy through supporting car-sharing schemes and city/village bicycles, for example.

4.5 Technology

Technological developments, especially digitalization, have had, and likely will have, a great significance in the possibilities to realize a low-emissions society. New technology represents a possibility for working "smarter," i.e. optimizing the use of resources. The global energy intensification today is 30 times lower than it was in 1970, and the global carbon intensity has decreased by about a quarter over the last 24 years (Jackson 2007).

As such, today new technology represents a potential for strengthening development towards increased resource use and increased emissions, if the increased efficiency is outweighed by the growth of the total resource consumption. Scenarios are used to picture different development tracks, which are based on many different presumptions, among others the degree of technological development (see also chapter 4.7). A scenario based on high technology solutions can still allow high consumption compared with today's. With low-technology solutions, the scenario rather contains solutions that demand a shift in consumption, and a powerful reduction of resource use.

In a low-emissions perspective, the following technological development traits can be particularly relevant (text based on South by Southwest, 2016):

- Many of today's jobs will be replaced by technology between now and 2050. This applies first and foremost to jobs that are performed according to determined rules and which can be programmed, for example different forms of case processing, accounting, auditing, etc. This means a large-scale transition to **digital service models** and business models.
- Growth of new **digital platforms** that form a basis for a shared economy through establishing market arenas that have significantly low transaction costs.
- Social media can become the new infrastructure for social interaction and can make for disruptive innovation.
- **Increased interaction** due to the use of tools that allow us to work interactively in projects on tasks. This means for example that today's plans can be replaced with continuously (dynamically) updating strategies and actions, which in principle can be updated and improved by everyone who takes part. This means, for example, that a local "low-emissions strategy" can be updated continuously and, at the same time, encompass a process with both creative phases and implementation.
- **Encourage interactions across institutions,** such building both practical- and interest-communities.
- Technology will, to an increasing degree, open for more **decentralized energy production and consumption** (local and flexible solutions), which together with developments within energy technology can both reduce energy consumption and make multiple local solutions possible. This challenges the centralized structures in the electricity markets, and can give the foundation for a global transformation of these (Schleicher-Tappeser 2012).
- **Health technology** makes it possible to monitor the body in completely new manners, also from home. Diseases can be discovered earlier, which gives higher rates of survival, higher quality of life, and reduced medication. It can also work towards reduced societal costs, and reducing the need for transportation and for building area that is used for treatment today.
- **Development of Virtual Reality.** Virtual reality is suited for social networking, computer games, virtual travelling, films, advertisements, education, conferences, and much more. This can mean that it is possible to replace long travels with local "experiences," and replace the need for physical structures. It can also open new possibilities in local and regional education, professional network building, and collaborations in both work and research. Used in this manner, the result can be the reduced needs for transportation, construction of educational places, and research centres, not to mention

transportation infrastructure.

- **Digitalization makes possible driverless vehicles.** This means possibilities for both more efficient sharing of resources and reduced needs for drivers. Through this, the cost structure within transportation can be significantly changed, making "mobility on demand" more common (and having ones' own vehicle less necessary).
- **Computer-managed cultivation of food.** Through combining computers and biology, the climate becomes democratized. Anyone can cultivate whatever they would like, with an extremely low consumption of water and energy. In the long run, this can make the world's food production more democratic and more environmentally-friendly. To a significant degree, this can contribute to a faster transition towards locally- and/or self- producing various foods.
- **Digital currencies** can contribute to a low-emissions society if they are used to create a circular economy and an economic system that makes local production and consumption more competitive.
- **Integrated use of computers between different actors and sectors** will make collaboration and optimization possible, particularly as applies to construction, operations, and use. For the municipality, this can mean a more optimized economy and reduced climate strains connected to infrastructure.

The increased and smarter use of technology by Norwegian municipalities will be important for many reasons. For local businesses, it is important for their ability to compete, for the municipality for streamlining its management and operations, and for individuals for continuous accessing information and optimizing one's own use of time and resources. At the same time, technological possibilities are hardly today's main challenge in the transition to a low-emissions society - that rather is the underutilized potentials of existing technology.

4.6 Municipal and region structure

The Norwegian parliament has decreed that today's 428 municipalities should be reduced through a municipality reformation, to produce robust municipalities with increased power and authority. Further, they have sketched a halving of the number of counties to around 10 publically elected regions (Stortingsmeldingen om nye folkevalgte regioner, 2016). The new regions will facilitate more efficient interactions between regions and the state. The decree recommends strengthened guidance of the regional publically elected level's work with climate, especially that which is connected to the existing national planning guidelines for climate and energy planning. Further, new national planning guidelines for climate adaptation will be developed.

Research results do not give a clear picture of whether or not climate policy is better safeguarded with larger municipalities. For example, studies show that adaptation strategies for climate change are developed independently of municipality size, but dependent upon engaged employees in municipal administrations and engaged local politicians (Dannevig, et. al. 2013, Wejs 2014). Larger municipalities can implement policies more efficiently, despite having challenges including resident involvement in that work. Small municipalities can have great success in their climate polices because it is easier to legitimize the climate policy agenda in a manner that it is seen as positive potential for local development (Kasa og Westskog, 2016).

Even if there is no singular picture of whether small or large municipalities are most effective when it comes to climate policy, the restructuring opens new arenas for new processes where larger areas and multiple functions can be seen in conjunction. This applies to which issues are addressed, to the organization of processes, and to the prioritization of solutions. Thus, this represents an important area of possibilities for the transition to a low-emissions society.

4.7 Scenarios and pictures of the future

Many have attempted to make pictures of the future for 2050. For changes in climate, the Meteorology Institute made a weather forecast for 2050, which has attracted a great deal of attention[5] . Snapshots of the future are a method for discussing how the world might look in the future, and they can be used to evaluate which decisions and interventions are necessary today in order to steer development trends in desirable directions. The scenario approach is often utilized to consider different potential development tracks. A typical distinction between scenarios has to do with the role of technology in solving societal challenges.

A book published in 2013 offers a view of the world in 2050, illustrating development traits through the interim years (Porritt 2013). Porritt's vision for 2050 is a dynamic

5 The weather forecast for winter 2050: https://www.youtube.com/watch?v=3FOyzK33L0Y

world where the vast majority of humans have good lives. He presumes that 90% of the energy will come from renewable sources, of which 30% will be solar. The focus is on humanism and the use of human capacity to make the world a better place for future generations. In the book, the established "truths" from after the world wars regarding continuous economic growth in a consumer society have subsided. Renting, sharing, and trading are the leading thoughts within consumption, and many businesses are established in all parts of the economy following a tighter one-to-one model.

One vision for Norway as a low-emissions society in 2050 is published in a report from Bellona (2015), where a diverse group of societal actors took part in developing the vision. Consumers' awareness around their own role and efficacy becomes increasingly prioritized. The vision shows a draining from the consumption-based society to an experience-based society, where economic growth as an ideal is exchanged with quality of life.

The scenarios under development by the UN's climate panel (IPCC) point towards where chosen paths lead in the long term. The main running scenarios are as follows (O'Neill et al 2014, 2015):

- **"The high way"** with continued commitment to the fossil fuel society. Market economy, innovation and globalization, and large investments in health and education in order to ensure good access to human and social capital are prioritized. The economy continues to be based on the exploitation of fossil fuels and rapid economic growth. Little effort to reduce environmental strains.
- **"Sustainability – taking the green road."** Inclusion and respect for the environment's limits, investment in health and education, reduction of differences and focus on human wellbeing are prioritized. There are few challenges with reducing emissions and adapting to climate changes.
- **"Inequality – a road divided."** Diverse investments in human capital give increasing differences in economic possibilities and political influence. Power is concentrated in few hands. There is moderate growth in industrial countries, while low-income countries fall behind. More conflicts come about. Environmental policies focus on the local level in industrialized countries. The challenge of reducing emissions is limited, but adaptation challenges are significant, particularly in poor countries.
- **"Regional rivalry – a rocky road."** High priorities are placed upon competitiveness, energy, and food-security. Regional conflicts force countries to focus on national and regional issues. Investment in education and technological development drops, international organizations weaken, and the living standards are difficult to maintain in many places in the world. The economy is strongly regulated, environmental policy is weak, and challenges connected to the reduction of emissions and adaptation to climate changes are significant.

A transition to a low-emissions society that means an emissions level of 1-2 tonnes per resident in 2050 is most similar to scenario "Sustainability – taking the green road," above.

Utopian, ideal societies are descriptions of a good society, or a form of society that individuals and groups long for, or attempt to make a reality. In daily speech and political rhetoric, the terms "utopia" and "utopian" are often used to characterize and define particular ideas that are unrealistic or not capable of being realized (Store Norske Leksikon).

Social researcher at NTNU, Stig Larssæther, has said that the society that the UN implicates in their 1.5 or 2 degree target is so removed from today's society that it is possible to describe it as a utopia or as science fiction. To make use of utopias is a way of looking at new solutions, but it requires another way to think of scenarios than what prevails today.

Within planning today, so-called "forecasting" is most applicable, i.e. starting with applicable trends and projecting from these. Based on experiences and projections from transportation growth, for example, new solutions are designed. Another approach is so-called "back casting," where the starting point is a desirable future, such as a low-emissions society. What do we have to do to get there, to reach that utopia? A utopia can function as a contrast picture which helps us to ask different questions about what we have to do with today's situation (based on Forskerforum nr. 8/2015, page 20).

An example is the Brøset project described in chapter 5.5, where the starting point was a desirable future condition – a climate-neutral district. The central question – what do we have to do to get there? – gives a different starting point for planning. At the same time, we do not have the knowledge about how the future will play out, but the method can contribute to giving valuable input and knowledge in the process.

For the municipal sector's development work towards a low-emissions society, the application of different planning methods and scenario techniques can increase the robustness of municipal planning.


TRANSPORTATION
CONSTRUCTION
FOOD

5. Main themes

5.1 Prioritized themes in the transition to a low-emissions society

The transition to a low-emissions society demands global reductions in emissions of around 80 to 90 percent, which corresponds to an emissions level of 1 to 2 tonnes per person per year. The emissions level is independent of whether the emissions happen directly where that person is, or through the production of everything that the person utilizes (the indirect emissions). A closer description of this can be found in chapter 3. The following main principles are recommended as laying a foundation for the municipal sectors choice and prioritization of efforts and working areas:

- Direct attention towards activities that affect both direct and indirect emissions and activities that have a high consumption of emissions-intense input factors. Since the emissions can happen both in and outside of each municipal border, the solutions should be evaluated in a live-cycle perspective (carbon footprint). See the explanation in chapter 3.
- Activities that the municipality can affect with today's range of instruments.
- Activities that have significance for the municipality as an organizational unit, but which require the development of new or reinforced existing municipal means.

In the local and regional transition work, it is recommended to choose central themes which:

- Connect as directly as possible to each municipality's situation and capacity to negotiate.
- Are easy to adapt to local processes and easy to communicate.
- Give a foundation for engaging each resident, local business, or organization.
- Contribute to making accessible knowledge and technology useable.
- Focus on driving forces behind resource use and greenhouse gas emissions (including indirect emissions)
- Have consequences within many established policy- and responsibility areas.

Such an approach will be different from what is done today through the international climate negotiations (macro), but would be an important, potentially decisive supplement. In light of the review of municipal emissions (both direct and indirect) in chapter 3, the development traits in chapter 4, and suggestions for main principles for choosing prioritization areas above, three central emissions areas stand out: transportation, construction, and food.[6]

These three areas encompass a large percent of the emissions that municipal enterprises, residents, and business actors cause, and touch themes that are closely connected to municipal roles and instruments. At the same time, each municipality and its own enterprises, residents, and business actors have a stake in these themes.

Transportation results in direct emissions in the municipality and indirect emissions from travelling outside of the municipality, together with emissions from the production and distribution of both vehicles and fuel.

Construction results in direct emissions through heating and construction itself, from transport to and from the building during both construction and in operation. It results in indirect emissions connected to the materials that go into the building and the purchase of energy (fuels, district heating, and electricity).

Food can be connected to emissions from cultivation and production processes, further processing and preparation, and the transportation in all of these steps. The emissions are distributed both amongst direct and indirect emissions.

Individual municipalities, residents, and business actors have a relationship to all three of these themes. The themes are part of most municipalities' service delivery and societal tasks, such as education, health and care, culture and sport, business development, and land allocation - including that for infrastructure for transportation, energy, water and drainage, and sanitation. Through giving all the actors insight and oversight over their own climate footprint, a dialogue about how the emissions can be affected through their own choices will be easier. At the same time, it highlights which choices must be taken at the system level. This will demand processes and communication locally and regionally. In larger municipalities, it will mean processes at the district, area, or province level.

6 "Food" includes both food and drink, i.e. foodstuffs.

The themes will be good entry points for developing a strategy for the transition to a low-emissions society. Each municipality can consider other themes that are important to focus on based on its unique context.

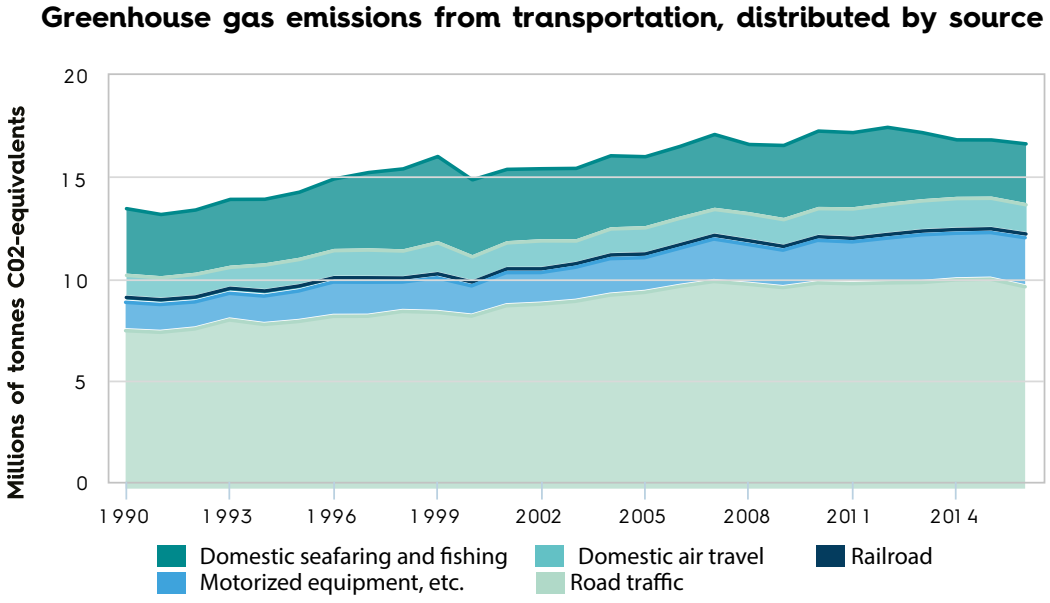
5.2 Transportation

Greenhouse gas emissions from transportation

Transportation is the largest source of greenhouse gas emissions in Norway. The transportation sector includes road transport, domestic air- and sea-faring, and other mobile sources. International air and sea faring is omitted. Emissions from transportation and mobile sources make up about 1/3 of the national emissions. These emissions increased by 12 percent between 2003 and 2013, and 30% between 1990 and 2013. Road traffic is responsible for half of the emissions (Norwegian Environment Agency 2016). The distribution of emissions in the transportation sector by transport type is shown in Figure 5-1.
The greenhouse gas emissions connected to building roads, along with bridges and tunnels, train tracks, boat harbours, and other infrastructure are also significant sources. The emissions sources include construction machines and material use, construction, and steel construction in particular. All emissions affect the climate, but not all are calculated as emissions from the transportation sector today. A comprehensive overview of the emissions contributions from the construction of infrastructure does not exist, and there is little data from experience connected to the significance of exploiting existing infrastructure. These emissions sources should, however, be included in the analysis of emissions-heavy activities and input factors for the transportation sector.

The emissions development from the transportation sector relates to the economic growth and population developments:

- A larger population brings the need for more personal and goods transport, together with better ability to pay gives us the possibility to travel more often and more efficiently.
- Technological development, streamlining, and new technology have slowed the growth of greenhouse gas emissions compared with the growth in number of trips and driven kilometres.
- The mode with which we travel and move ourselves has changed in the last decades, and particularly the number of leisure trips has increased significantly. Better economy has given us the potential to use faster forms of transport, and the use of personal vehicles and flights has risen at the expense of bus, train, and boat.
- In the largest cities in Norway, there has,



Source: Statistics Norway (SSB) License: NLOD

Figure 5-1: Emissions distribution between transport type and –development from 1960 to 2014. Source: Miljøstatus.no..

however, been an increase in the portion of public transportation use for daily trips since 2005, according to the national travel behaviour surveys. Among other things, this is contributed to a better public transportation offer and restrictions on car use

Interventions for greenhouse-gas reductions from transportation

There are primarily three types of interventions for reducing greenhouse gas emissions from transportation. These apply for road traffic, flights, sea-faring, fishing, and other mobile sources:

- Reduce the total need for transport
- Transition to transport types with lower emissions, such as bicycling instead of driving cars
- Employ technical interventions that reduce emissions per transport type, for example electric cars instead of diesel motors.

In addition, greenhouse gas emissions from the construction, operations, and maintenance of infrastructure can be reduced by using zero-emissions technology, environmentally friendly fuels, and by making climate-aware choices for materials and material amounts.

Reducing the total transport need and transition to more environmentally friendly transport

En kompakt by- og tettstedsutvikling er en forutsetning for å redusere transportbehovet, og få til bærekraftig mobilitet, dvs. overgang fra personbiler til kollektivtransport og mer sykkel og gange.

A compact urban- and village development is a precondition for reducing the transport need and reaching sustainable mobility, i.e. the transition from personal vehicles to public transportation and more walking and bicycling. The compact place as a model for sustainable urban- and village development is expressed in the national planning guidelines (SPR) for coordinated housing-, area-, and transportation planning (2014). Theoretical and empirical insights in relevant literature also primarily agree in their recommendations regarding what type of area and transportation development gives reduced car traffic and thereby facilitates the reduction of emissions (based on Tennøy, et al. 2013):

- Land use should be steered towards densification, with car-independent localization and strengthening of urban and local centres rather than urban sprawl.
- Public transportation offers should be improved (frequency, speed, punctuality, area coverage).
- Bicycling and walking should be better facilitated.
- Restrictive means against car traffic should be used, both physical (road- and parking capacity) and economical (parking fees, road pricing, tolls).

The construction of new houses, office buildings, hospitals, etc. should be concentrated in areas with good access to public transportation. In addition, the overall transportation work should be reduced by facilitating for example car-pooling, car sharing, and emissions-free, coordinated goods distribution.

Technological trends and interventions

The technological development of new energy carriers and new motor technology can have considerable significance for reducing greenhouse gas emissions from transportation both on land, on the sea, and in the sky. This applies both to improving traditional technologies and to developing new – for example, zero- and low-emissions technology for transportation means like electric and hybrid vehicles and the use of bio-fuels.

Building charging- and fuel infrastructure for zero-emissions vehicles is necessary for triggering potentials. Technological development goes quickly, but there is uncertainty whether the technology and fuels can be introduced in large enough scopes fast enough. When taking into consideration target areas beyond greenhouse gases, individual interventions within other intervention areas might offer larger gains than individual interventions within technology and alternative fuels. For example, technology interventions are more reasonable than other interventions for reaching the zero-growth target for traffic in the large urban areas, where greenhouse gas emissions are seen in isolation. However, the zero-growth target simultaneously offers increased value by affecting sustainable urban development and mobility solutions, promoting physical activity and health, reducing air pollution, noise, and land area use (NTP 20 Grunnlagsdokument - basis for the national transportation plan).

Ruter's strategy for public transit in Oslo and Akershus is an example of developing a regional and local low-carbon transportation system. See the frame next page.

The municipality's role

The municipality, between regional area- and transportation plans and the municipal plan's area portion, lays the premises for both the scope and means of transportation infrastructure, together with the scope and composition of the transportation (travel means distribution). In addition to a land area strategy that is built upon a compact urban development and place-making, the municipality can stimulate and set the conditions for active mobility planning in individual planning and construction projects.

By testing out and making use of new technologies, for example in their own car- and bus parks, the municipalities can contribute to technological development. The solutions can entail the need for adjusting infrastructure and long-term agreements. The municipalities can further facilitate the establishment of charging stations for electric cars, the production of bio-fuel from municipal sewer and biological waste, the establishment of bio-fuel stations, etc. The car's role should be redefined from owning one's own car to sharing and having access to a car when needed.

In the work with transportation, the municipality has the potential to affect a series of other actors beyond their own enterprises. The theme occupies the residents and is important for business life locally and regionally. At the same time, transportation is an important part of business politics, tourism, housing politics, shopping, and agriculture. Local strategies for low-emissions transport can therefore carry many repercussions.

Figure 5-2: It is flexible, effective, and easy to travel without a private car in the future's every day. A digital mobility assistant for reaching integrated mobility services is central.

Development of a low-emissions transport system in Oslo and Akershus

IPCC, 2014: When developing low-carbon transport systems, behavioural change and infrastructure investments are often just as important as developing more efficient vehicle technologies and using lower-carbon fuel.

Ruter's strategy document M2016 takes a step beyond the public transportation strategy, towards a mobility strategy. See Ruter M2016. Here, there is the recognition that a public-transportation business like Ruter should take a broader grip on mobility challenges, along with its collaboration partners and operators. As a starting point, this was driven by political agreement over the ambitious goal that personal car traffic in Oslo should not grow. M2016 asks what is necessary for public transportation, together with bicycling and walking, to carry the growth in passengers. The vision for the future is that a denser and more integrated mobility offer will make it easier for customers to leave their car behind and still have freedom and flexibility in their daily life. The steps towards this future build upon a combination of known solutions and new development strategies. Solutions which combine mass-transit with individual, tailor-made solutions have to be combined. The key is a tight network of travel possibilities with high frequency, large capacity, modern technology, accessibility for walkers and cyclists, along with individually suited information- and mobility- solutions.

5.3 Construction

Construction as an emissions generator

Globally, the building industry is responsible for more than a third of the world's greenhouse gas emissions, a third of the world's waste, 40 percent of the world's energy use, and 40 percent of global use of natural resources (metals, minerals, forests, etc.). When one includes the transportation of building users in the operations phase, construction is responsible for at least 40 percent of the global emissions.

In the life cycle of a building, the following factors are central drivers for greenhouse gas emissions:

- Energy use and greenhouse gas emissions connected to daily operations (heating, cooling, lighting, etc.)
- Energy use connected to the production and transportation of construction materials
- Energy use connected to the construction phase through site preparation
- Energy use connected to transportation to and from the building in the operations phase
- The end of the life cycle, energy use, and greenhouse gas emissions connected to demolition work, transportation, and waste management.

The importance for Norway to focus on the construction sector in order to achieve their climate objectives is not mirrored in the low direct greenhouse gas emissions that are appear in the municipally distributed emissions numbers (Figure 3-3), beyond the first point on the list above. The reason for the low direct emissions from this sector is that a large portion of its energy needs is covered by electricity, which is primarily produced from renewable hydropower in Norway. Public means have therefore primarily been directed towards the objective of removing fossil fuels from heating buildings. The electricity from hydropower is, however, a valuable resource, which can be exported[7]. Changes in energy usage in Norway can therefore indirectly give emissions effects in European power production

The construction sector is the largest consumer of material resources in Norway (St. meld. 28, 2011-2012). Indirect emissions connected to materials and installations used in the building are a significant portion of the building's total emissions and can largely be affected by the construction sector as a purchaser of construction materials and equipment. Emissions from the transportation of people to and from buildings is affected by their localization and the facilitation of transportation types.

In addition, a significant portion of the energy usage, particularly in office buildings, goes to equipment like computers, chargers, telephones, management systems, and audio equipment. The EU estimates that this energy use will increase in the coming years (EU-commission, 2011).

7 Norway is a part of the Nordic and European power system with the objective that all EU lands should have the capacity to exchange at least 15 percent of their consumption and production across the national borders by 2030 (EUs "Roadmap 2050-low-carbon-economy").

Reducing emissions through life cycle based greenhouse gas calculations

Under the direction of Standard Norway, a Norwegian standard is being developed for calculating the greenhouse gas emissions from buildings (NS/K 356). Statsbygg has developed the model klimagassregnskap.no, which among others, is applied in the national development programmes Future Cities and FutureBuilt. One of the objectives with calculating greenhouse gas emissions in different phases of development and construction of urban areas is to introduce emissions efficiency as a precondition for planning, design, and construction. In this manner, greenhouse gas emissions can become an integrated part of the foundation for investment decisions.

Through good processes and the right decisions, a series of projects show that greenhouse gas emissions can be reduced by more than 50 percent (compared with an alternative using non-central localization together with traditional material choices and today's regulated (TEK 10) energy requirements).

Calculations examples show that the transportation of users to and from the building in the operations phase (60-year perspective) in some cases contributes by more than 50 percent of the building's total life-cycle emissions. In these cases, the building is typically localized far from urban centre functions and public transit nodes, and the users have no alternative to private vehicles for coming to and from the building. At the same time, other examples show that the "right" localization can lead to 70-90 percent reductions in emissions from transportation (FutureBuilt, 2016, Statsbygg 2012, Selvig et. al.).

This highlights the significance that localization of buildings and coordinated housing-, land area-, and transportation planning have for greenhouse gas emissions.

By implementing known technology and the right localization, the examples in Figure 5-3 show that the life-cycle emissions can already today be reduced by more than half, without significant increases in costs. The choices of building design/architecture, materials, and energy solutions have a clear significance as well. The lowest emissions are reached through localization connected to urban centre functions and nodes for public transportation, area-efficient buildings (for example multi-use), and the exploitation of existing infrastructure.

With stricter energy requirements, the gains in reducing emissions of other lower energy needs lessen somewhat, but remain meaningful. The emissions contribution from the materials in a building (the production of these) would then make up an increasingly larger portion of the building's total emissions.

Area efficiency can reduce the use of energy and resources, while simultaneously giving lower costs per person, and is a central parameter for reaching gains in emissions reductions. For example, area efficiency can be stimulated by setting requirements for the energy use per person or function rather than per square meter.

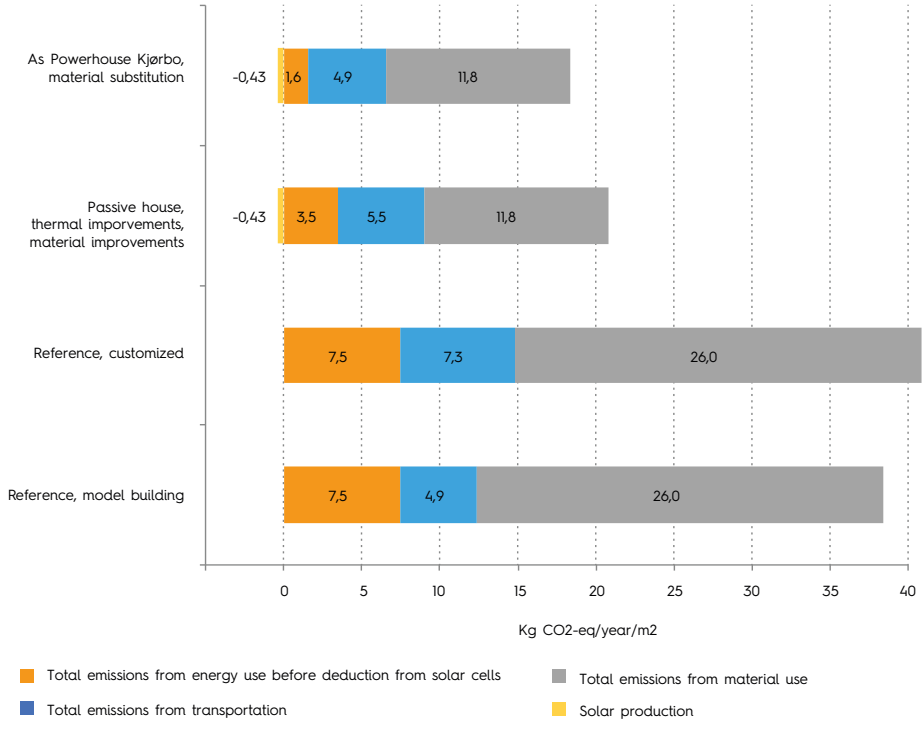


Figure 5-3: An example of emissions distributions from a building (office building) before and after intervention. Source: Civitas, unpublished.

In 2050, existing buildings will still make up the largest volume of the building mass, and the main part of the building mass is built based on earlier building regulations, with far less energy efficiency than today's. The examples in Figure 5-3 (Powerhouse) and Figure 5-4 show that renovation projects can reduce emissions connected to the body of buildings by 90 percent compared with building new buildings.

Development trends for the future's buildings

Zero-emissions building

Norway is far ahead in the global context and has a series of pilot buildings, which show the potential for energy and greenhouse gas reductions. Zero-emissions building is a potential solution for a comprehensive development of the future's buildings. The buildings should not contribute with greenhouse gas emissions in the course of their lifetime. This means that the greenhouse gas emissions that are caused by the production and transportation of materials, erection, operations and maintenance, and the disposal of the buildings must be "repaid" through the use of renewable energy. Precedent projects have driven the environmental developments in the Norwegian construction industry, with a great deal of help by public programmes like Future Cities, FutureBuilt, and Zero Emission Buildings (ZEB). The research centre ZEB has nine different pilot building projects that have been realized or are being planned today.

These pilot projects show a substantial variety of solutions. The work is done in collaboration with a series of both private and public partners from the Norwegian construction industry. As a part of the project design and construction, knowledge and technical solutions are developed which the partners can use in other future-oriented projects (for example new building systems, solar panels to be integrated in facades, etc). Some examples of the pilot projects are summarized below or online at http://www.zeb.no.

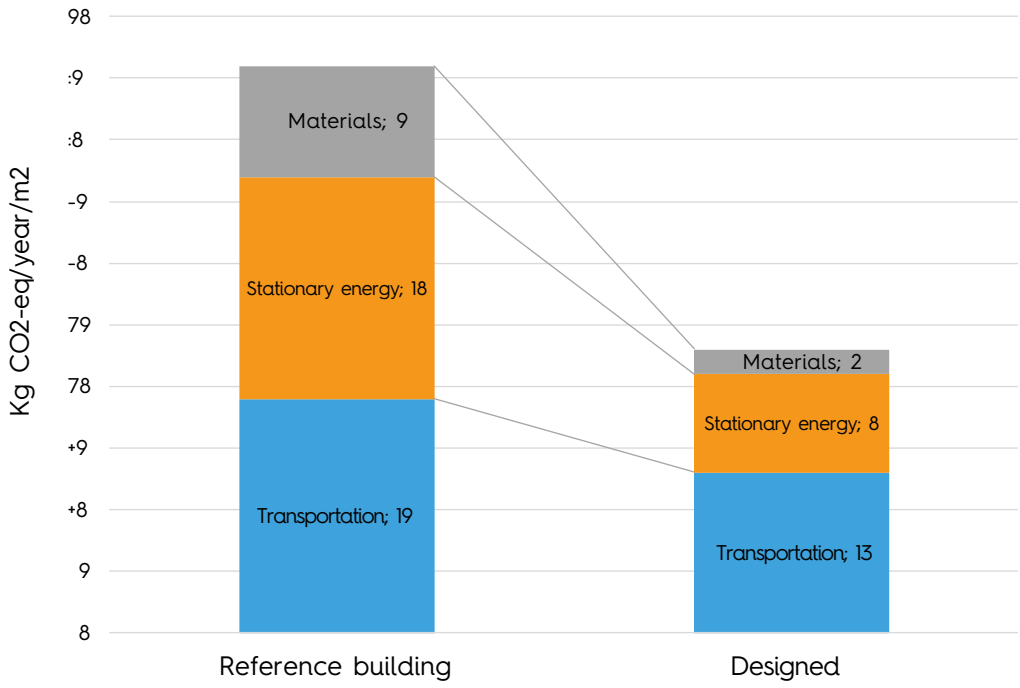


Figure 5-4: Example of reduced emissions after a building renovation intervention. The renovation of a large office building; reuse of the substructure, energy streamlining to a passive house level, removal of car parking spots. Source: FutureBuilt.

Figure 5-5: The building compensates for greenhouse gas emissions through both energy in the operations phase and in the building materials.

Powerhouse Brattørkaia, Trondheim

Powerhouse Brattørkaia is an energy-plus house concept where the shape of the building was determined by environmental and energy requirements to the same extent as other functional requirements. The project is an important contribution to innovation and technological development that answers the climate challenge in the built environment and is an excellent pioneer project.

The architecture and aesthetic expression are steered by the sun as an energy source ("form follows environment"). The building's design, plan solution, roof solution, façade, and energy- and ventilation solutions stem from the energy and environmental constraints. A slanted, southern exposure roof gives an optimal relationship for solar cell based energy production, something that is decisive for the building to achieve a net positive energy production. The innovation of Powerhouse is the sum of all its interventions. From the first day of the project, it employed a collaboration model where all the professional disciplines cooperate closely. This model was critical to the project's implementation and successful results, and it contributed to new thinking. The result is a completely new architectonic expression. The environment-steered building shape has, however, challenged the planning process and brought about changes in local zoning regulation.

The office building is around 13,000 square meters for around 500 workers. The surplus energy in the building's operations phase will cover the energy that went into the production of its construction materials, erection, operations, and disposal over the course of its lifetime. In total, the building is estimated to have a surplus each year of around 5 kWh per square meter. Buildings that produce as much or more energy than they use in their operations (energy-plus buildings) can offer a central contribution to reducing overall energy use and thereby on a large scale, reduce greenhouse gas emissions globally (Powerhouse alliansen 2016).

Figure 5-6: The multi-comfort house, an example of the future's house, built in Larvik. Source: ZEB/Snøhetta/Brødrene Dahl.

The multi-comfort house in Larvik

The building compensates for emissions from materials and energy use in operations by producing electricity, which is exported out to the energy network. The house is defined as ZEB-OM[1] (Operation and Materials).

The building shows that both design and material choice follows from its environmental ambitions, including well-utilized areas and daylighting. The direction and angles of the roof are optimized for solar panels. The materials are reused from older buildings (brick), recycled materials, and wooden materials.

1 ZEB-OM: Renewable energy production of the building compensates for the greenhouse gas emissions from its energy use in Operations and from the production of its Materials.

Figure 5-7: Illustration of Zero Village Bergen as it will be developed by ByBo AS. Illustration by Snøhetta.

Zero Village Bergen

As Norway's first and largest housing area with 800 zero-emissions homes, Zero Village Bergen will provide knowledge, pilot construction, and experiences that can answer how Norway can tighten is regulations by 2020 towards reaching zero-emissions. The buildings are placed in the terrain in a manner that minimizes CO2 emissions while maximizing sunlight. This makes the infrastructure of the area rational. Green areas and areas for the production of local food are placed centrally. The neighbourhood's location has good potentials for environmentally friendly mobility for daily tasks.

Zero-Emissions Neighbourhoods

The first pilot buildings show that ZEB's ambitions are high and that it can be demanding to reach zero emissions, both economically and technically. Studies of how zero-emissions buildings and –neighbourhoods can be developed further therefore become important. The objective must be that the building mass as a whole becomes a lesser strain to the climate, i.e. that each individual building does not need to reach zero-emissions as long as all the buildings together reach it. This can happen through the development of zero-emissions neighbourhoods (ZEN), which means that urban blocks, entire districts, and housing areas should reach zero-emissions in the course of their lifetime (ZEB TU 0216). See the example in the frame below.

A new research centre for environmentally friendly energy (FME ZEN) was established in May 2016 with NTNU and SINTEF as hosts, financed by the Norwegian Research Council and 35 partners. The centre's vision is "sustainable areas with zero-emissions of greenhouse gasses." In order to reach this, the project will (zeb.no):

- Develop tools for designing and constructing the project as well as planning zero-emissions neighbourhoods
- Shape new business models, roles, and services that contribute to flexibility through the transition to a zero-emissions society
- Develop cost- and resource-efficient buildings with environmentally friendly materials, technologies, and construction systems
- Develop technologies and tools for design, construction, and operations of energy-flexible neighbourhoods
- Develop tools for optimizing local energy systems and their interaction with the general energy system
- Develop seven zero-emissions areas that will function as innovation arenas and trial neighbourhoods for the technologies and the solutions that are developed by the centre.

Zero-emissions areas will rely upon the interplay between several buildings, infrastructure for energy and transportation, and area development.

Other development characteristics and trends both internationally and nationally include::

- Increased focus on flexible buildings and area efficiency, i.e. less square meters per person in homes and per employee in office buildings.
- Better utilization of buildings through shared use of functions at different times.
- Sharing of common functions, for example small private living units with access to common rooms, electric cars, bicycles, etc.
- Housing and office buildings without car parking, but with good facilities for bicyclists, bicycle parking, and a good public transit offering.
- Green facades and roofs for local food production.
- Energy production with large battery packages integrated in the buildings, some with electric cars as a part of the battery package.
- Off-grid where, for example, small single-family houses in rural areas are completely self-sufficient with energy and water (inside and outside).
- Tiny Houses, which are extremely small homes of 20 to 30 square meters, which make use of compact solutions - either on or off the grid.
- Houses based on local and locally sourced building materials and resources, adapted to local conditions.
- High-tech building materials with extreme insulation properties among others.
- Low-tech buildings without technical installations, just some electricity and broadband.

The municipality's role

The municipalities have the responsibility to create frameworks for what areas can be built, what can be built in different areas, and to approve detailed plans of construction projects. At the same time, the municipalities have their own properties, which can be used as instruments, for example through pioneer projects. Buildings are also important for individuals, whether they are homes or business buildings. Quite a few actors in local society manage or develop buildings and are potential contributors to the transition work locally and regionally.

Through planning and establishing construction- and transformation areas with ambitions for climate-neutrality, successful results depend upon early planning stage focuses upon potential energy distribution solutions, building forms, and transportation solutions. The municipalities can facilitate resilient local energy production and the connection between micro- and macro-energy systems. Alternative living concepts, employment forms, and multiple uses are central to a climate perspective and contribute to the reduction of area usage per person. These themes have not typically been the focus of traditional planning processes, though municipalities can play a central role in these processes.

Climate-efficient material use in a life-cycle perspective will also be important, and the municipalities can, for example, promote the use of wood in their own buildings.

5.4 Food

Greenhouse gas emissions

Food is a theme that concerns everyone. A great deal of emissions are connected to the production and distribution of food, especially meat. Direct emissions from the agriculture sector correspond to approximately 25 percent of the global greenhouse gas emissions (IPCC 2014). In the municipally distributed emissions, direct emissions from agriculture make up 13 percent (SSB-note 2016-04). The emissions from the food sector are even larger when the indirect emissions are included, for example the emissions from the transportation of food.

Fisheries contribute to greenhouse gas emissions particularly through use of fossil fuels. Fish products generally have lower indirect emissions than meat products (especially red meat), but are still significant (Winther et. al. 2009). Around 90 percent of the greenhouse gas emissions from Norwegian agriculture is connected to feed for livestock production[8]. If the production were changed from red meat to grain, for example, emissions can be reduced by up to 50 percent. This would simultaneously lead to a drastic restructuring of the consumers' diet and is therefore not a very realistic intervention in the short-term. Another intervention is stopping new cultivation of marshlands, which, following calculations, can result in an emissions reduction of 4 to 7 percent (Grønlund og Harstads 2014). The use of livestock fertilizer to produce biogas would also contribute to a reduction of emissions.

To calculate the emissions from individual foods is difficult, for example whether the emissions from grazing animals can be offset by binding it to the carbon in the meadows and pastures that they graze upon (Hille et. al. 2009; Leip et. al. 2010).

Interventions for reducing greenhouse gases

Based on today's knowledge, we can, with relatively high confidence, give recommendations for climate-friendly food (Hille et. al. 2009, 2013; Nymoen og Hille 2012). For example, greenhouse gas emissions can be reduced though:

- Eating more vegetables and less meat
- Eating by local seasons as much as possible. This gives a reduction in the emissions from storage, transportation, and processing
- Using vegetables that are produced on open land rather than in greenhouses, particularly if the greenhouses are heated with fossil fuels
- Wasting less food

Further, small-scale urban food production can increase green areas in cities (for example on roofs), and thereby reduce the effects of intense precipitation in cities (Mentons et. al. 2006).

Some examples follow below.

The municipality's role

The municipality's direct responsibility is limited to its own enterprises here. Through the municipality's role in connection with agriculture, stimulating urban agriculture, public health, business development, and tourism, it is possible to motivate actors towards food production and consumption that is advantageous both with respect to greenhouse gas emissions (direct and indirect) and towards other local synergies. For example, increased consumption of climate-friendly food offers health and other gains, and can therefore engage other groups beyond those concerned with climate and greenhouse gas emissions (Briggs et. al. 2012).

8 The paragraph is based upon Grønlund og Harstad (2014).

Smaller plate sizes offer less food waste – research study

CICERO's researchers, together with GreeNudge and Nordic Choice Hotels, have conducted an experiment with some of the chain's hotels, aiming to find out how food waste from the hotels' buffets can be reduced. The restaurants that had smaller sized plates reduced food waste by 20 percent and the guests were just as satisfied. Part of the explanation lies in the simple expression "our eyes are bigger than our stomachs."

Nordic's commercial kitchens generate 840,000 tons of food waste each year, which corresponds to 1.6 million tons CO2 - or the emissions of 800,000 personal vehicles. Reducing plate size can be an intervention for reducing food waste and cutting greenhouse gas emissions.

High-tech production of food

In Linköping in Sweden, a skyscraper that facilitates the cultivation of food is being built by Plantagon. With a steadily increasing need for food for a growing global population, it is tempting to also make use of urban areas for food production. The skyscraper in Linköping is an example of cultivating vertically rather than on flat land area. This can offer relatively large crops on a small amount of land. In the skyscraper, the plants are cultivated from above in a spiral-shaped ramp and can be harvested from the bottom. A robot moves each plant box downwards in the spiral a small amount each day. Watering and fertilization as well as the movement of the plants is automated.
Intensive cultivation like this has some advantages – among others that the food is cultivated precisely where it will be consumed. This saves emissions from transportation. There are also better potentials in cities to exploit the by-products for different cultivation processes, for example using surplus heat from elsewhere (Teknisk Ukeblad 2013, Plantagon 2016).

Comprehensive efforts on sustainable food in cities

Oslo municipality took part as one of ten European cities in the project «Sustainable Food in Urban communities».

The objective was to develop low-carbon and resource-efficient urban food systems through focusing on the cultivation, distribution, and consumption of food. Beyond that, Oslo chose a life-cycle focus and included food waste in their project. Through the project, the participating cities had to make an action plan and establish a network for sustainable food. The European project was a network collaboration where experiences were exchanged amongst the different participant cities.

In addition, the network for sustainable food that began in Oslo is a forum for collaboration in the municipality that is seen as important for meeting the objectives set forth by the action plan. The action plan for sustainable food for Oslo municipality is based on system- and lifecycle-approach. A comprehensive approach to food means from earth to food to earth. The main objective is for Oslo to achieve a sustainable food culture with the following goals, which cover social, environmental, and economic aspects of sustainability:

1. Oslo has 10% organic food consumption in 2018.
2. Oslo facilitates urban agriculture, which together with local agriculture contributes to an increased understanding of food production.
3. Oslo supports food traditions, including the provision of food, raw ingredient knowledge, and cooking.
4. Oslo's indirect greenhouse gas emissions will be reduced and Oslo's residents will eat less meat and waste less food.
5. The municipality of Oslo will prioritize societal responsibilities when making food purchases.
6. Oslo will sort wastes and recover materials from food waste and yard waste.

5.5 Integrated solutions

The three focus areas - transportation, construction, and food - must be seen together in many cases, for example in connection with urban centre and area development. Knowledge, education, and inspiration regarding how to ensure good processes and implementations as well as solution ideas can be found in relevant projects elsewhere. Through planning and establishing construction- and transformation areas with ambitions of climate-neutrality, an early focus upon potential energy distribution solutions and building shapes is of great importance. For example, the design and placement of building masses will determine the potentials for efficient utilization of solar energy and the efficient localization of energy production can minimize heat loss. Active mobility planning can contribute to ensuring future-oriented and sustainable transportation while also focusing on health through the facilitation of walking and bicycling. Through the planning process, a minimum "blue-green" amount can be secured in order to facilitate both food production and local stormwater management, while also ensuring a focus on climate adaptation and biodiversity.

The examples that follow illustrate variants of the term integrated. The example "High technological local life-cycle concept" is one project that addresses the three central themes (transportation, construction, and food) in an integrated manner in the transition to a low-emissions society. The example also illustrates the Netherlands' efforts in innovation and sustainability, through local, national, and international perspectives. Through a more dialogue-based development, the project represents a step towards becoming a radical innovation strategy (see Chapter 7.4).

High technological local life-cycle concept, Almere, Netherlands

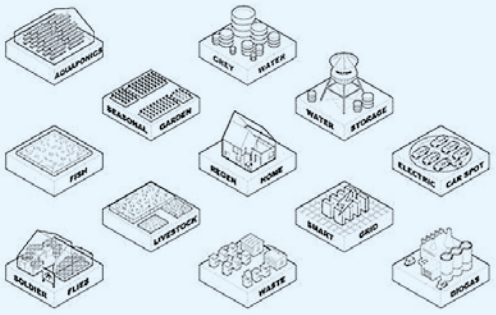
The Dutch project ReGen Villages (http://www.regenvillages.com/) is based upon the need for rapid development of off-grid residential environments. High degrees of innovation and the implementation of modern technology is prioritized. The life-cycle principle offers a basis where local lifecycles include the production of solar energy, biogas, cultivation of vegetables, production of fish and chick, utilization of rainwater, and turning organic waste into fertilizer. The housing is simultaneously integrated into a greenhouse, which means increased use as garden/growth/living even in the cold part of the year. The planned start of construction for the first 100 houses in Almere is the summer of 2016.

At the same time, the project is a part of a larger effort where the objective is rapid and global construction of off-grid neighbourhoods. This means that one thinks and shops both locally and globally, and through that, the driving forces behind globalization can be used to spread concepts that are locally based.

RReGen Villages is an example of avoiding the need for both external energy and resource supplies (level I). At the same time, they address the three central themes for transition to a low-emissions society (construction, transportation, food) in an integrated manner. The concept also entails producing housing efficiently and using modern technology to find economically sustainable solutions. This prioritizes that the residents to a large degree can affect the development of their own neighbourhood. Through a more dialogue-based project development, the project represents a step towards a radical innovation strategy. The project's approach, paradoxically enough, is well aligned with living in traditional societies and tribal cultures, as it is based on a fundamental sustainability through limiting what is used (and shared) to the resource base which the society is dependent upon (ref. figure 4-2 which illustrates what circular economy entails).

The project is also an experiment in the sense that traditional institutions (public land area planning, traditional financing, etc.) follow an alternative strategic concept. The concept's challenges include finding ways to unite the technological approach with attractive place making in the constructed neighbourhoods.

The project is part of the Netherland's reinforced efforts in both innovation and sustainability, which have local, national, and international perspectives. The project can be seen as a part of the Dutch tradition for innovation and transition, where innovative housing concepts and the transition to a green economy has been realized in practice. ReGen, therefore, can be seen as a strategy that can supplement and challenge densification and urbanization strategies. This implies that the transition to a low-emissions society in Norway might renew its post-war strategic platform for cities and districts (city and land, hand in hand) (ReGen Villages 2016).



ReGen System

Illustrasjon: EFFEKT Arkitekter

Illustrasjon: EFFEKT Arkitekter


Illustrasjon: M.Herzog / visualis-images

Brøset – a climate-neutral neighbourhood

In 2013, Trondheim municipality approved an area plan to develop Brøset, 320-decares envisioned to form a climate-neutral neighbourhood with an attractive residential environment that good to live in. Through promoting values like community, green surroundings, and car-free locality, the aim was to show that it could be attractive and easy to choose a climate-neutral lifestyle.The project's planning became a pilot for trying out new models for urban development and planning processes, using four parallel planning teams. This gave a broad basis for the work with the area plan, along with knowledge about which interventions should be prioritized at that level with consideration to residents' carbon footprints. At the same time, they found several preconditions for a climate-neutral neighbourhood that cannot be ensured legally through zoning plans and planning regulations. Qualities beyond the legal basis of the Planning and Building Act can rather be achieved during the construction, through sales contracts when the property is turned over (the neighbourhood properties were owned by Statsbygg, the health authority, and the county). Such a model demands a broad mandate and clear divisions of responsibility when it comes to following up requirements beyond the Planning and Building Act. The research project "Towards carbon neutral settlements..." was tightly connected to the municipality and development of Brøset. The summary of that research project (Støa et. al. 2014) can offer both knowledge and inspiration.


Illustrasjon: Helen&Hard

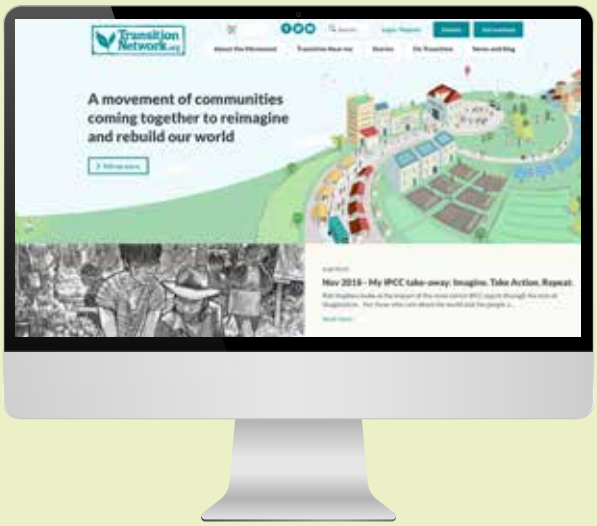
Urban centre plan Hurdal

In 2014, Hurdal's municipal council approved a vision for becoming an "energy-plus society" by 2025, i.e. carbon-neutral or better by 2025. The urban centre plan that is under development takes a comprehensive approach to sustainable place making and construction. The plan has a focus on social and cultural relationships with plazas and meeting places, along with the aim of further developing local businesses using local resources. Among other things, the houses are planned as energy-plus houses, which should include as much local timber and environmentally friendly materials as possible. The houses will be built with solar panels and green roofs. In the regional plan for Oslo and Akershus, Hurdal centre is defined as a transit node, and the municipality sees the value in this regional cooperation. Chapter 7.10 (catalyst leadership) also includes a description of the process Hurdal "energy-plus society 2025."

Transition Towns

The transition town movement is based on local grassroots initiatives where residents and local stakeholders take leading roles in the development of resilient and sustainable local societies – focusing on self-sufficiency and approaching independence from petroleum. The movement began in England in 2006 and over a thousand Transition Towns can be found across the whole world today. Totnes, England was the first Transition Town. A broad spectrum of interventions are implemented in order to strengthen local businesses, increase local food production, increase the production of renewable energy, and the like. In Norway, the Transition Town projects "Sustainable life" (Bærekraftig liv) in Landås, Bergen and "Transition Sagene" in Oslo were started in 2010, and more have come since then. Transition Town initiatives require a positive and constructive relationship to local government (Hopkins 2008), and it is considered important for Transition Towns to maintain their status as grassroots initiatives, anchored in civic society and independent from party politics.

A good collaboration between Transition Towns and local governments contributes to getting the most possible out of resources, engagement, and the possibilities connected to local stakeholders and residents. In the UK in 2008, Sommerset municipality approved the objective of becoming the first Transition Town authority through supporting the local Transition Town initiative.



Localization of national enterprises

Localization has a great significance for sustainable urban development, place making, and greenhouse gas emissions. National enterprises can become important motors for urban development and place making depending on their localization, which should be underpinned by clear requirements to include climate and urban development perspectives in project conditions and decision-making. Critical conditions for using area efficiently and contributing to urban life include allowing for multiple uses of developed spaces and facilitating that urban space facing first floors are occupied by publicly oriented enterprises. How the municipalities' have incorporated these objectives in their own policies and area plans often plays a significant role, along with the municipality being involved in the earliest planning phase.

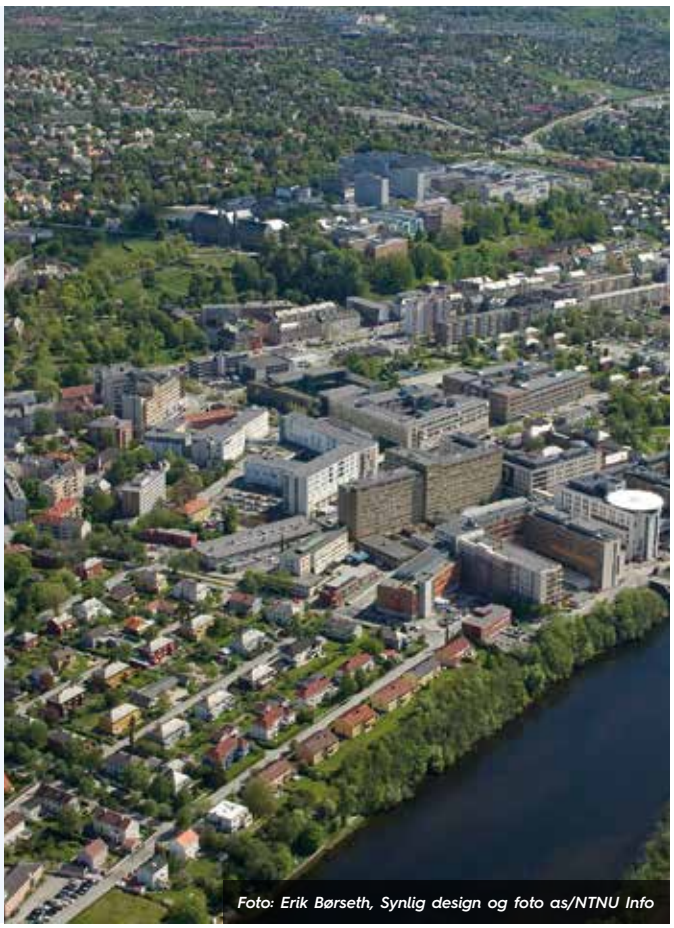


Foto: Erik Børseth, Synlig design og foto as/NTNU Info

6. From efficiency-improvements to transition

6.1 The need for change

The national and municipal perspectives regarding climate work have predominantly looked at how "environment and climate" can be safeguarded as one of many considerations within today's systems and organization. They take this on, reasonably enough, within a broad spectrum of sectors and themes - in their own enterprises, as planning authorities, and as societal actors. The question has primarily been handled as efficiency-improvement work based on making use of new technologies. Few questions are asked regarding the scope and need for the activities. A low-emissions society demands coordinated emissions reductions at a minimum of 80-90 percent. This means a level of reduction in a series of areas, which are not possible to reach through efficiency improvements alone. The municipalities have to utilize their existing significant technological potentials and develop further ones, while also considering how tasks can or must be solved in completely different manners. Critically, they must encourage residents to choose climate-neutral lifestyles, by making them attractive and easy.

A challenge in the work towards transitioning to a low-emissions society is to establish a common understanding for the issues along with long-term political and administrative consensuses, which can sustain political terms and shifts in political leadership. The locally and regionally elected officials have to practice leadership in a process where it will be necessary to set new questions on the agenda and ground them in a long-term time perspective. The goal of a low-emissions society has to be set as a general governance objective. In that manner, elected officials can collect the necessary competence and engagement as well as form routines and practices that lead towards a low-emissions society..

The realization of a low-emissions society demands that the climate challenge is seen as a basic change of the municipalities' coordinated scope of challenges and possibilities. It is recommended to see the climate challenge in a civil-protection perspective, where the starting point for a low-emissions society and the frame for the transition work are sustainable and resilient local societies and regions. Climate- and energy plans which follow the national planning guidelines, will not be sufficient (see chapters 3.2 and 3.3). The needed approach will depend upon strategies with concrete guidelines for land use, infrastructure, transportation solutions, municipal services, housing policy, health policy, business policy, climate adaptation, employment, etc., along with a thorough evaluation of how the municipality's enterprises should be organized. It is necessary to develop a systematic approach, and a framework that stimulates the evaluations and implementations of diverse interventions and instruments.

Distinguishing between three intervention levels is recommended:

Level I: Efficiency - Improving efficiency within today's structures and systems thinking

Level II: Development - Developing manners to perform activities and solve tasks, moderate system change

Level III: Transition - Transitioning, prevention, and changing the system

6.2 Efficiency

Interventions at level I primarily happen within today's structures (land use, infrastructure, construction, transportation, etc.). Improving efficiency means that interventions are implemented which are relatively well known and easy to implement. Interventions at level 1 will mostly likely not reach a sufficiently low emissions level by 2030. The estimate for this level's potential for reducing greenhouse gas emissions is around 20-30 percent. Starting interventions at level II and III must therefore also be implemented in a 15-year perspective.

The most accessible technology within existing systems is that which is already being employed, which implies a limited degree of innovation. A large number of interventions at this level are considered important to implement in most municipalities, and there is a great deal of readily available experience and knowledge. Interventions at this level can be implemented within today's sectors and areas of responsibility. However, political will is needed to initiate climate interventions, which becomes even more effective alongside better-coordinated uses of national and municipal instruments.

Through efficiency improvement interventions, the municipality will gather experiences and motivation that reinforce efforts at levels II and III.

6.3 Development

New and more climate-efficient ways to perform "the same" tasks are established and put to use in level II. The transition from private vehicles to public transportation or from an energy system based on fossil fuels to one based on renewable energy sources are examples. The potential for reduction in greenhouse gas emissions is believed to be up to 50 percent.

Level II interventions include more encompassing processes, together with the need for heterogeneous competencies within leadership/organizations and within specific professions. At this level, "packages" and agreements, for example, can be tailor-made and developed for each region or urban area. The need to develop new institutions and innovation processes increases, including the needs for collaborating in networks and project groups, or for establishing new units within the municipality's base organization and owned businesses.

There is a need to combine traditional steering (government) with models that facilitate collaboration between different actors (governance). Interventions will often demand a reprioritization and coordination between actors, as in through urban environment agreements for example. The need for organizational and financial innovation will increase, highlighting issues to be taken on at level III.

6.4 Transition

Transition has to do with changing over to a low-emissions society where the knowledge about the background for human-created climate change is recognized and interventions that reach society are introduced. In that, transition means developing new strategies with the aim of prevention, so that emissions are not created.

This means implies the need to question the scope and prioritization of different activities and their need, for example:

- Efforts towards an integrated development of urban centres through new forms of collaboration between stakeholders within housing, business, shopping, food production, recreation, water, health, etc.
- The need for new building areas to be reduced through multi-use and shared functions.
- The need for energy for heating and cooling to be reduced due to, for example, fewer square meters of office area per employee and fewer square meters housing area per person.
- The need for motorized transportation to be reduced through blending functions within the same areas based on walking- and bicycling distances.
- The need for new infrastructure to be reduced through denser utilization of building masses and less motorized transportation.

The potentials for reducing greenhouse gas emissions are uncertain and difficult to estimate. There is a lesser extent of ready-made solutions or answers regarding how transition interventions should be realized, which collaboration forms, or what new potential law work is necessary. At the same time at this level, there are larger potentials for fundamental (radical) innovation, and it is relevant to develop new and more appropriate models (of theory and practice) for organizing society. For example, a circular-economics approach that prioritizes proximity between resources, production, and consumption would offer a completely new basis for municipal policies.

Sharing resources can be an important transition strategy, for example in connection with sharing buildings, transportation forms, areas, infrastructure, etc. Level III will have the largest need to develop a broad spectrum of instruments (financial, juridical, organizational, professional, risk handling, facilitating, etc.). If established structures and institutions are also changed, the transition can become a form for "creative destruction."

At level III, it will be critical to include indirect emissions as a foundation for strategies and intervention evaluations. This means that emissions from activities that happen outside of a municipal border, or are connected to goods and services produced other places, are taken into account. Seeing the climate strain from a life-cycle perspective (carbon footprint) becomes fundamental.

Transition strategies and interventions at level III mean maintaining an increased degree of complexity, which means that they are more challenging than interventions at levels I and II. However, interventions at this level are considered necessary to realize a low-emissions society and to maintain it in the long term.

The North Harbour in Copenhagen – "5-minutes' city" is an example of level III transition, see the frame on the next page.

Illustrasjon: By & Havn I/S

North Harbour in Copenhagen – 5-minutes' city

In the course of 30 – 50 years, the North Harbour in Copenhagen will be developed into an area with 40,000 residents. The project aims towards integrating different aspects of sustainability and has strongly prioritized development and transition. The transition perspective is embedded in the project's name, which indicates that it should be possible to live a good life in the city within a travel distance of 5 minutes. The plan includes a social and cultural offer, which contributes to laying a foundation for a local urban life in the North Harbour. The ambition of leading "the good life" with transition in practice is an example of the ambition this report denotes as "local quality."

The example illustrates that, in addition to future-oriented energy solutions, changes at level III (transition) make an objective of preventing resource use, i.e. through reducing the need for transportation and through co-using or sharing building areas and volumes. The example shows that concrete solutions (concepts) for transition are closely connected to local context (ref. Figure 7-2).

The priority of bicycling in the North Harbour can be seen as a further development of both Copenhagen's strategy for bicycle use as environmentally friendly transportation, and of Denmark's strategic positioning in the significantly growing international market for goods and services connected to bicycling and sustainable transportation. There are many parallels to example from Almere in the Netherlands, even if the physical solutions are different (ref. Chapter 5.5). The North Harbour and Almere can be seen as examples of the significant translation of new thinking into practical concepts and solutions. In both examples, the new thinking is framed as the starting point for local circular economies, sharing resources, and solving fundamental needs (employment, housing, recreation, culture, social services) in manners that prevent the use of energy and natural resources.

Source: https://stateofgreen.com/en/profiles/ramboll/news/5-minutes-to-everything-new-neighbourhood-nordhavnen, 2016.08.02.

6.5 Examples of interventions reducing emissions

Today, the three main themes of transportation, construction, and food are strongly tied together through land area-, transportation-, and construction-policies. In a time perspective of 15-30 years, each will also have a significant technological dimension, which has serious implications upon the evaluation of "good" low-emissions solutions. Examples of this are:

- Zero-emissions and energy-plus buildings, off-grid buildings – which are now being built by both public and private actors at large and small scales
- Zero-emissions vehicles, electricity-based vehicles (directly or through hydrogen) - which are already being phased into Norway, which has more than 70,000 electric cars today
- High-technological micro-cultivation of food in homes – something a bit into the future, but on the way.
- Reuse, recycling, and reclaiming of all resources – which are developments being phased in as a part of Norwegian and international waste policies

Through such technological development, many of the arguments against driving private vehicles will be nullified in the long term (high greenhouse gas emissions, emissions that make poor air quality, large system solutions for energy distribution, centralized small housing units, etc). The negative sides of motorized transportation and driving private vehicles

	Construction	Transportation	Food
Level I	- Reuse/renovation of existing buildings - Improve building area efficiency - Make requirements for energy monitoring in municipal buildings	- Improve technology, renewal able diesel, electric cars - Practice EcoDriving - Build infrastructure for fossil fuel-free fuel vehicles (i.e. energy stations)	- Waste less food - Reduce meat consumption - Improve fertilization planning - Prevent new cultivation of marshlands - Reclaim energy from landfill gasses
Level II	- Integrate energy production in buildings as part of renovations (for example solar panels) - Localize construction at transit nodes and urban centres - Build zero-emissions buildings - Use climate-efficient materials	- Change to more climate-friendly travel forms (for example from car to public transit) - Use green modes for goods delivery - Bicycle and walk - Use cargo bikes - Change from fossil fuel vehicles to those powered by renewable sources	- Facilitate local production for local consumption through land area allocation - Use biological wastes from agriculture and municipal drainage for energy purposesl
Level III	- Develop good places to live which give potentials for a climate-neutral lifestyle - Utilize building masses optimally – co-use and shared solutions - Housing-concepts and work types that reduce area use per person	- Travel less - Develop integrated mobility solutions - Hold virtual meetings - Use internet-based education and training - Support E-health and preventative medicine	- Support locally sourced food, sustainable foodstuffs, and seasonal foods - Cultivate at home with high-tech solutions - Capture carbon through municipal energy recovery facilities - Utilize food waste and sewage for biogas

Figure 6-1: Examples of interventions for emissions reductions.

remaining will include occupying land, barrier effects, accidents, and resource-intensive infrastructure.

Today, there is knowledge, experience, competence, and technology that demonstrates how there are quite a lot of good reasons for, and possibilities within, implementing interventions. Below are some examples of a "common starting point" in the form of interventions and development projects that may be relevant in many municipalities.

6.6 Coordinated concept development – Land area, transportation, and construction.

Strategies for sustainable, resilient solutions

Transportation, construction, and food make up a large percent of the emissions that municipal enterprises, residents, and business actors cause (ref. Chapter 3.2 and Chapter 5). A coordinated area-, transportation, and construction policy is a key instrument for establishing the necessary structures to reach lasting emissions reductions. There is a need to strengthen and further develop the work by framing a better relationship between transition strategies and decisions connected to land area use and physical solutions.

In particular, it is considered important to develop more coordinated strategic concepts - both processual and solution-focused – across different sectors and administrative levels. This primarily applies to land area allocation, infrastructure development (especially for transportation), and large development areas and construction projects (for example the localization and main solutions for large public building projects).

Such an approach can contribute to further developing the interactions between land use and transportation solutions, the use of conceptual studies (konseptvalgutredninger KVU) in public projects.

And in the national localization policy. (See for example, the frame in chapter 5.5 about the localization of national enterprises). The approach can contribute to the discussion about how "the compact city/village" should be realized, which many take for granted as being a sustainable strategy despite its challenge to ensure quality in the broader sense. The compact city as a model for sustainable urban development and place making is expressed in the national planning guidelines for coordinated housing, area, and transportation planning (2014). The planning guidelines give strong political signals to the municipalities, which are the most important authorities for urban development and place making, including that (translation from the guidelines):

- "Planning should contribute to developing sustainable cities and villages, facilitate value creation and business development, and promote health, environment, and quality of life..
- Construction patterns and transportation systems should promote the development of compact cities and villages, reduce the need for transportation, and facilitate climate- and environment-friendly transportation forms...
- In city and village areas, and around public transit nodes, high utilization of land area, densification, and transformation should be particularly prioritized..."

Environmental sustainability means more than a reduction in greenhouse gases, such as the protection of biodiversity and green infrastructure, for example. Densification can impair existing residential qualities by, for example, minimizing common goods like urban spaces and outdoor recreation areas and reducing access to sunlight. For the transition work, it is considered critical to use an approach that focuses on realizing multiple important societal objectives together, "win-win" solutions, in order to simultaneously develop rather than impair local qualities.

The examples in this report together with the input from the informants reinforce the need for strengthening the processes that happen within the frame of the national Planning and Building Act. An elaboration of this is included in the Norwegian version of this report.

Multiple perspectives in densification processes

To a growing degree, Norwegian city and village planning are discussed as developer-led and – negotiated (Nordahl et. al. 2011), or as an urban governance "network-ification" of urban politics (Fimreite and Medalen 2005). The role of private developers in urban development and place making continues to grow in the power of being property owners and through responsibility for detailed master planning and implementation of development projects. Often, existing property borders limit the chances for comprehensive planning and implementation. This continues to happen despite the Planning and Building Act granting municipalities the right to reject master plan proposals for individual properties and to demand cooperation between landowners in order to regulate larger areas in relation to each other.

Planning processes today often go in parallel with project development, so that crucial decisions are already taken when the regulating plan document is set out for public hearing. Hanssen (2013) has pointed out that crucial approvals are made before public hearings, and that the affected parties and representatives for civil society come in too late. Multiple studies show (Hansen et. al, 2015) that the dynamic in densification processes happens between the developers, planning administration, and local politicians – and that the developers' contact (lobbying activity) with local politicians often leads to political decisions which depart from the general guidelines that the politicians themselves have earlier set forth.

Densification will therefore often meet protests from affected neighbours, neighbourhood associations, and other local organizations. This contributes to increasing the contention levels in area planning and project implementation. Potentially conflicting goals and the safeguarding of both environmental and social sustainability require the participation and involvement of the affected at an early point in time – in order to utilize local knowledge and gather input as early as possible in the process. Dialogue and collaboration between developers, the municipality, and interest groups early in the planning process can contribute to better results and processes that are more efficient because knowledge, objectives, and results are more broadly anchored (see Chapter 7.9 about collaboration-driven innovation).

Heterogeneous ownerships can also strengthen the need for coordinated concept development processes directed towards anchoring a conceptual foundation for the low-emissions society (see Figure 7-2), for example in neighbourhood development. The potentials for good concepts can be strengthened by mirroring them in the juridical frameworks made during municipal plan processing and in implementation models. This may mean that there is a need to supplement the municipal plan and municipal plan processing as follow the Planning and Building Act with vision-building processes and a declaration of organizational and financial expectations. Through different roles (see chapter 7.8), the municipality can ensure good collaboration process in all phases of a project's implementation, and at the same time safeguard democratic principles like participation. This can broaden the room for possibilities when it comes to future-oriented, sustainable construction that contributes to a low-emissions society.

At the same time, many of the examples in this report show that systematic work with political and administrative processes for ensuring objectives and quality (environment, climate, vernacular, universal design, multi-functionality, anchoring, cultural environments, etc.) makes it possible to reach both good results and innovative solutions, i.e. the example of Powerhouse Bratterøkaia in Chapter 5.3.

Well-connected area-, construction-, and transportation- policies

An objective of transportation policies in urban areas is that increases in traffic should be handled by public transportation, bicycling, and walking (the "zero-growth" in traffic target). It can be prudent in the meantime to discuss whether that target is adequately ambitious in a transition to a low-emissions society. A more critical approach would not just affect emissions from vehicles, but also consider the indirect emissions connected to infrastructure and vehicles. It is recommended to discuss whether these are perspectives which should be illustrated in the next roll-out of the Norwegian Transportation Plan (NTP) - the parliaments leading document for traffic investments - for example. These are considerations that also ground Ruter's strategy (Chapter 5.2) and the innovation arena Transport 2.0 (Chapter 7.9), which can serve as conceptual inspiration generally for the municipal and transportation sectors.

Extending that idea, additional relevant discussions may occur over how development and operations of infrastructure in their entirety can be optimized and coordinated in order to contribute to a sustainable transition through such measures.

The path towards a low-emissions society will demand a stronger coordination of area- and transportation policies. A central challenge is that the responsibility for area- and transportation instruments is distributed across different departments and administrative levels. Close consideration of the following is recommended in order to strengthen central instruments in area and transportation policies:

- Urban environment agreements and urban development agreements should be seen in relationship to each other and strengthened as tools for binding agreements between the state, the region (counties), and affected municipalities. The agreements should give clear guidelines for land area use, density, etc., and be adapted to the different regions. The relevant themes in relation to the climate perspective should be a main focus.
- All regions should develop and implement regional area- and transportation plans with clear objectives and priorities for land area use, densification, etc. Regional area- and transportation plans that each municipality has contributed to within that development must be binding for the municipality's own planning, and generally included in the review of development proposals from private and public actors.
- Where planned road construction for personal vehicles is in conflict with climate objectives, the planned road construction should be revaluated in light of the climate perspective.
- The climate perspective should be systematically integrated into choice of concept evaluations for national investments (building and infrastructure), and made into a central part of choice justifications.

Development of the Planning and Building Act

Sustainable development entered into the Planning and Building Act (PBA) as an important element in 2008, together with considerations for accessibility, public health, and children and youth's conditions growing up. The PBA has yet to set its own provisions that could solidify clear commitments for Norwegian municipalities to reduce greenhouse gas emissions. However, it has solidified that the law should promote sustainable development and climate considerations. What the law contains could be characterized as general formulations that do not give clear guidelines for action (Stokstad 2014).

A national planning guideline for climate and energy planning (SPR) under the PBA was approved in 2009. This guideline obliges the municipalities to develop a climate and energy plan (whether as a part of the municipal plan or in a special municipal part-plan). There are also requirements that the plans should be revised regularly. However, the planning guidelines are rather open when it comes to the content in such plans. The planning guidelines are not concrete about which interventions or instruments should be included, or about what is considered satisfactory. Neither have the municipalities envisioned objectives that are more concrete, nor are there explicit potentials for sanctions to them for not doing so.

The legal means for governance can therefore be characterized as "soft" means (Stokstad 2014). Kasa, et.al (2016) studied the extent to which the national guidelines in the SPR are followed up and have survived in Norwegian municipal planning. For municipalities that were in a start-up phase of their climate policy in 2009, the SPR was utilized in connection with formalizing structures, activities, and establishing connections to other policy areas. However, for municipalities that had already come further with their climate policy, there was little change. These latter found little of use in the soft regulatory measures. For the municipalities who were not interested or believed they did not have the capacity to do anything, the soft measures had no consequences. The municipalities were not sanctioned or held responsible for lacks in their climate- and energy-planning or in follow-ups of their energy- and climate- plans.

This study points to the problem of using soft measures when they are not supported with incentives, obligations, or sanctions from harder means. This can also be understood as too "weak" an institutionalization of the transition work (see Chapter 7.7 about institutionalization).

In summary, this indicates that it is not sufficient for municipalities to facilitate for development through defined frameworks (for example through municipal land area part-plans). In the future there will be a need for a far more proactive approach that lays a foundation for processes based on broad participation, open innovation, and catalysing leadership (see Chapter 7.10).

At the same time, experience from the municipal environment- and climate work since the 1980s shows that an institutionalization that is sufficient to meet the transition challenge we face has happened to a limited degree. A challenge today is to change the focus of conversations and discussions about the climate challenge from natural science, technology, and physical solutions/design, to a discussion of how municipalities should frame their discussions and solutions. The transition challenge demands a high degree of awareness of one's own context, preferably along with a genuine political will, to contribute to a transition. It can therefore be necessary to discuss how the PBA can be developed into being the best possible juridical foundation for the municipalities' work with transition to low-emissions society. However, changes that should possibly be made must be discussed far more broadly, given that the PBA is a very central and all-encompassing law. Nevertheless, some relationships may be eligible for closer discussion include:

- The need to strengthen the municipal sector's potential to connect the work with strategic concept development more closely to the PBA and to general strategic work. In connection with the plan strategy work (following the PBA), many important discussions are being had about what the region and the municipalities should focus on in the next four years. The strategic level in planning should be lifted and clarified in a manner where municipalities and regions develop strategies, concepts, collaborations- and implementations models to a greater degree, which surmount to a sustainable development that includes low-emissions society in practice.
- Collaboration with national stakeholders directed towards developing the public sector's skill to coordinate during the transition to

a low-emission society. Coordination can include different national sectors becoming better aligned, the state and municipal sector collaborating better, and the public sector developing coordination with other societal actors. It may not be necessary to anchor these processes in PBA, but they are processes that are important for reaching solutions that lead to a low-emissions society.

- In particular, there is a need for the state to take a comprehensive responsibility for coordinating their own construction projects. National localization and construction projects should be discussed and become subject to requirements in a manner that includes climate and urban development perspectives in their conditions and evaluation bases. The coordination between the state and the municipalities/region should also be discussed (see elaboration regarding the localization of state enterprises in Chapter 5.5).
- The need to make processes more demanding for attempts to realize construction on unbuilt areas, and to contribute to a stronger prioritization of the municipality's plan work through that.
- The need for municipalities and regions to initiate and/or become catalysts for processes that do not necessarily need to be anchored in the PBA, but which remain important for realizing low-emissions solutions (see Chapter 7.10 regarding catalysing leadership). This role is also central in order to handle different forms of conflicting goals and dilemmas in a manner that increases the quality of individual projects.
- For example, the municipality can invite other actors (private developers, volunteers, state actors) into processes, rather than limiting themselves to clarifying planning frames and conditions through land area planning. This may also mean inviting oneself into processes where the municipality does not necessarily have formal role, but where interaction, especially in the early phase, is important. For example, integrated housing- and urban centre development, where there is a need to negotiate conflicting goals between densification from a climate perspective and quality in a broader sense.
- Further development of the collaboration between the municipality's review and processing of detailed plans. This can include the use of development agreements directed towards strengthening quality and financing solutions that contribute significantly to the transition to a low-emissions society.
- The question regarding to which degree the PBA should give guidelines, and how the municipalities should relate to the reduction of greenhouse gas emissions (i.e. requirements for reduction, requirements for doing evaluations and greenhouse gas calculations, requirements to report, etc.). Otherwise, whether the law should be a process law, which thereby would clarify that it is a local and regional- political responsibility to realize the transition to a low-emissions society and shape the best solutions for local society.

7. From contention to collaboration

7.1 Climate as a contentious problem

In Norwegian administration and politics, climate has often been included as an environmental protection question. Experiences from the environment- and climate work since the 1980s (see Chapter 3.3) show that it is hardly sufficient to see the climate challenge as an environment problem that can be handled within today's organization.

Many good projects, networks, and preventions programs in the municipal sector have highlighted significant local and regional space for manoeuvrability. However, the municipal sector has not fully recognized that the climate challenge demands a more fundamental approach and the development of other ways to organize the change work. The perception or "framing" of climate as an environmental question has therefore, to an increasing degree, shown itself to be insufficient. The climate challenge cannot be limited by geography or by area of responsibility to one sector or profession.

The transition to a low-emissions society has to begin by seeing the climate challenge as a contentious or wicked problem. A wicked problem (Rittel and Webber 1973) is characterized as a challenge that appears unsolvable, for example due to opposing views (conflicting goals), incomplete information, and that the problem has multiple complex and intertwined underlying causes. Attempts to solve such problems can lead to even more contentiousness, for example if one does not go into depth and implement a sufficiently broad analysis of the challenges and the underlying driving forces. It could be particularly unfortunate if this creates an impression that the problem is handled through good efficiency improvement interventions (level I), for example, while a more fundamental question (especially level III) goes unaddressed.

A wicked problem has neither set instructions that can be followed, nor set working forms or methods when it comes to solutions. It will be difficult to handle a wicked problem though thinking in the same manner that gave the foundation for the problem. Part of a wicked problem is connected to our preconceptions (mental models). This means that in the transition to a low-emissions society, it will be critical to reframe the climate challenge[9] in a reasonable manner. This can increase the attention directed at the driving forces behind, or causes of, the climate challenge.

This report's suggested focus themes for low-emissions policy (construction, transportation, food) and the distinction of interventions into three different levels can give a reasonable frame for the transition work in each municipality. In general, a great deal of space for possibilities may be opened by focusing upon legitimate needs and underlying presumptions rather than instruments and solutions.

Innovation that challenges norms (see the frame below) is an example of an approach that reflects upon the underlying presumptions prior to designing strategies and interventions.

Innovation that challenges norms

A norm-challenging perspective means that limited structures and norms are highlighted and used as starting points for changes. One focuses on power and norms as they affect what is considered "normal" and how it is possible to change the norms in a desired direction. (Translated from source: http://www.jamstall.nu/fakta/normkritik/)

An example of innovation that challenges norms is the project "Women on Wheels," run by Living Cities Stockholm AB. The objective is to strengthen women's quality of life through increasing bicycle use. In many lands, bicycling is not considered womanly, attractive, or moral. The development of a new business model is therefore based on an innovative approach and solution, as applies across bicycle design, infrastructure, and work directed towards changing the views connected to women's bicycling.

Source: http://www.vinnova.se/sv/Resultat/Projekt/Effekta/2009-02191/Women-on-Wheels1/

9 "Framing" is a complex set of values, preconditions, and perspectives which we do not question, but which we use to create meaning. Reframing can also be perceived when something significant changes. The change can be done through changing what is prioritized and reinforced (or toned-down) through language. An example of reframing is changing the parameters by looking at the climate challenge as an insurmountable problem that is not reasonable to handle locally, to looking at it as a source of innovation and quality in the local society. The framing is also called "the box" which we think inside of. To think "outside of the box" means that the framing is changed.

7.2 Conflicting goals

Experiences from the climate work in the municipalities show that there can be many experienced contentions or conflicting goals, for example:

- **The potential for relatively short-term economic gains being put before the need for investment in solutions that would give less greenhouse gas emissions in the long-term.** For example, construction upon previously undeveloped areas for housing and vacation homes.
- **The prioritization of interventions that solve problems within today's structures rather than prioritizing interventions that change the need or the demand.** For example, meeting the need for increased road capacity or increased capacity in the energy system rather than reducing the need (i.e. growth in demand) through alternative transportation or energy distribution.
- **The need for jobs and local tax income in the short-term** rather than investments in projects and business development which is sustainable and climate-friendly in the longer-term. An example is the construction of areas with vacation homes rather than investment in transition to local tourism directed towards creating new, sustainable businesses and jobs.
- **The desire to replace publically owned businesses rather than aiding these businesses (national and municipal) to use resources (and collaborate) towards good integrated solutions** that contribute to a transition to a low-emissions society.
- The wish **to avoid "unpopular" interventions, for example limiting personal vehicle use, rather than communicating the solutions that are best with respect to the climate.**
- The objectives for **densification around transit nodes,** and the reasoning behind **residential- and environmental- qualities** and quality in the public space.
- **Densification** of areas at risk for rising sea levels or flood, rather than climate adaptation.
- **Governing** and control from political and administrative leadership rather than facilitating more open, **participatory** processes based on trust.
- The desire to **deliver results** within **each area of responsibility**, rather than using resources on processes and interventions that include **innovative integrated solutions** for the local society.
- The desire for **predictability** and established methods/tools for developing good strategies and innovations, rather than the need for **flexibility** and skills for allowing strategies to emerge.
- The desire for **legally obligating tasks** rather than **local democratic processes**.
- Whether **competition** or **collaboration** is best suited to reach a transition.

7.3 Barriers for transition

Climate challenges have been seldom approached through changing organization within the public sector. Administrative work with coordination of conflicting challenges is among what is described in "Against all odds? Paths to coordination in Norwegian administrative" (title translated from Norwegian, Difi 2014). The main conclusions from that report are:

- The administration is divided
- The coordination is too weak. There is a need for better vertical and horizontal coordination.
- Objective- and result- steering is adapted to sectoral steering. This is not a hindrance for coordination, but it has limitations in the form of not including inter-sectoral challenges and coordinating knowledge that lies with different stakeholders.
- Financing sources for inter-sectoral tasks are weak.
- The sectoral model, with established objective- and result- steering, is not adapted to contentious/wicked problems. Difi's report points to the need to develop inter-sectoral organizations, so that a well-organized project- and network work can supplement the sectoral steering.

Difi's analysis is particularly relevant when it comes to the transition to a low-emissions society, because it points to both limitations and potentials in today's steering model. Even if the report first and foremost applies to national enterprises, it shows through experiences from the municipal sector's environment- and climate work that this is a challenge where the organization of the municipality is little considered.

Since the 1980s, a great deal of the focus in the municipal sector has been upon improving the efficiency of service production and organizing enterprises in business areas (New Public Management). Both the state and the municipality are thereby affected by the lack of implemented changes in administrative practices, institutions, and processes that are adapted to the challenge represented by transitioning to a low-emissions society. Norway also has not had

more substantial incentive programs directed towards strengthening local and regional climate policies, as has Sweden, for example (Kasa and Lundqvist 2016). In the research literature, many barriers for transition are pointed out for the municipal sector to transition in a climate-friendly direction (Amundsen et. al. 2010, Vevatne and Westskog 2005, Kasa and Westskog 2016, Aasen, et al. 2015, Kasa et. al. 2012):

- The lack of relevant competence to lead development- and innovation processes in municipal administrations.
- The lack of human and economic resources (sustainable projects) for local and regional processes for transition.
- Weakly developed organization when it comes to interdisciplinary efforts (programmes, projects, networks) directed towards reaching necessary integrated solutions in practice (area development, construction projects, transportation solutions, energy solutions).
- Weak multi-level governance and limited collaboration between different administrative levels. For example, the municipalities experience that what the national authorities expect of the municipal sector is unclear, including in which manner the state and the municipality can establish different forms for collaboration and partnership.
- Limits in established objective- and result steering systems when it comes to addressing and "solving" the climate challenge as a contentious or wicked problem.
- The lack of networks (nationally, regionally, and locally) directed towards realizing low-emissions solutions.
- Weak economic incentives that are suited in both breadth (interdisciplinarity) and depth (addressing questions at different levels) in the climate challenge.
- Too little focus on contributing to integrated and sustainable solutions across many freestanding public enterprises, including businesses owned partially or fully by municipalities.
- The lack of good statistics and measurement tools for climate emissions locally makes the evaluation and follow up of the effects of different implemented interventions difficult.

7.4 From conflict to innovation

A characteristic of wicked problems is that they often are best handled through collaboration between people with different competences, perspectives, and roles. This means that it can be fruitful to be restrained in "planning" solutions that do not build upon good enough processes.

In the transition to a low-emissions society, it will therefore be important to focus on the significance of formulating good questions, which open for participation and dialogue. This can frame the challenges we face in a manner that initiates fruitful processes, which, in the best cases, can overcome conflicting goals and provide innovative solutions (win-win) (Galtung 2003).

This means that conflicting goals "disappear" if one can solve multiple fundamental needs at the same time. A good strategy for urban centre development would give significant emissions reductions while providing business development and creating a more attractive urban centre, for example. Good conflict management thus has many similarities with innovation

What is dialogue?

Dialogue is understood as a verbal interaction where two or more participants share experiences, ideas, or insights. Dialogues can be symmetrical where all the participants are equal, or they can be asymmetrical where one of the parts has a task of helping the other with the process (facilitator, teacher, coach, therapist, or mediator). Dialogues can be verbal or written, spontaneous or planned, thematically open or limited to a theme.

The opposite of dialogue is debate, which is one verbal game where the participants seek to win over each other. Debate is a verbal means of struggle, while dialogue is a verbal collaboration. We can shift quickly back and forth between dialogue and debate, and in that manner create grey zones. However, the two can also be cultivated in order to function differently. The word dialogue comes from the Greek dia (=through) and logos (=words, reason, opinion). Through communicating in dialogues, we create a "fluidity of opinion." The word debate comes from the Latin de-battere, which means, "to beat down." We find the word again in baton, battalion, and battle. (The word discuss comes from the Latin dis-cutere or dis-quatere which means to beat or shake into pieces). Section translated from http://www.norskdialog.no/Omoss/Definisjon-av-Dialog.

processes, in that they create consensus about good (new) solutions and the realization of them. Dialogue is critical to both types of processes and it is an important means for the transition to a low-emissions society.

An analysis of the challenges and possibilities in public steering when faced with budget and natural resources pressures is offered by Majgaard (2013) distinguishing between:

1. Simple steering
2. Reflective steering
3. Transformative steering

The three levels build upon each other and do not replace each other. With simple steering, the objective and the requirements for results are solidified in planning- and steering- documents. However, simple steering has weaknesses when it comes to developing coordination and innovation. In many cases, the steering model is not where problems are solved, but where the stakeholders develop strategies for "surviving" within an existing system.

Reflective steering entails that it is possible to have a dialogue about the dilemmas that simple steering creates, for example through conversations where the different sides see and recognize each other's objectives and perspectives.

Majgaard (2013) also points to the paradox inherent in that many who argue for comprehensive leadership

Drammen, Norway – transition and innovation

Drammen is a well-known example of a transition process in Norway. The city was plagued by industrial pollution (paper factories), sewage pollution, and significant problems with through-traffic. Today, Drammen stands out as a transformed city, and the factors that have contributed to that transition include crisis understanding, the potential for new use of old industrial plots in urban renewal, and not least the work that was discontinued in the processes that should have led to change (Tørnblad et. al. 2013; Nenseth, Tønnesen, and Westskog, unpublished article).

In the 1980s, the engagement for a cleaner river in Drammen and a campaign from the organization Nature and Youth contributed to attracting outside focus to the problems. The local politicians were, however, not unanimously positive to decontamination interventions because they might conflict with local business. With the assistance of national grants in an "Environmental Package," Drammen took a U-turn and changed from an industrial place and a traffic crossing to being a river city and environmental city.

This transition was led by both political processes and processes working towards the population and business life (for example the process of establishing Papirbredden – neighbourhood development with combined educational institutions, housing, culture, and business). Through this, political consensus was reached despite party lines, and both the population and local businesses accepted the transition process. The transition policy was thereby "sedimented," (in Tolberg and Zucker's 1996 understanding of the word) and a transformed city resulted at the end of the process.

Drammen is an example of how the work with environment- and climate are tied together with different concrete efforts, and which in different manners are institutionalized (Figure 7-2). An example is the "Buskerud city" collaboration, which is a regional collaboration over area and transportation. The collaboration has laid a foundation towards concretizing a large financial package/urban environment agreement ("Buskerudby package 2"), which builds upon a common regional area plan.

Correspondingly, Drammen's focus on the environment and competence has been an important starting point for the FutureBuilt programme (see the frame in Chapter 7.7). The establishment of Papirbredden also shaped a foundation for further institutionalization through the establishment of innovation businesses, a competence development program, and the FutureBuilt pioneer project (building phases 2 and 3). The urban development in Drammen can be seen as a transition process that to a great degree has been based upon establishing strategic processes. This means working with an understanding of context (development traits, possibilities, challenges), and connecting them back to (especially political) processes, which ensure decisions about projects, financial packages, and agreements (partnerships, establishing businesses, etc.). This also relates to the municipality's prioritization of developing its role as a societal actor (see Chapter 7.8).

Even if Drammen still has significant potential when it comes to climate efficiency, many of the means that are utilized in earlier processes are interesting in the municipal sector's transition to a low-emissions society. Furthermore, it can be interesting to move the focus from interventions to concrete solutions in the transition work (see the table in Chapter 6.5), towards how local and regional political processes can be strengthened.

do so from their own partial understanding. Reflective steering is not sufficient for innovation and transition. It is when the conversations become exploratory that it becomes possible to find surmounting solutions. Developing processes through good dialogues and conflict management thus becomes a key to transition. In such processes, a large degree of mutual trust between different stakeholders can also be created. Drammen is an example of a transition process – a city that went from industrial place and traffic crossing to a river- and environmental city (see the following frame).

7.5 From individual interventions to radical innovation

The transition to a low-emissions society entails many interventions in the three levels, improving efficiency, development, and transition. The interventions should not be exclusive, but should supplement each other. Figure 7-1 shows how the three levels can be seen in relationship to each other and in respect to simple, reflective, and transformative forms of steering. The figure illustrates that the transition to a low-emissions society will demand a diversity of processes and interventions that span from individual interventions with simple steering mechanisms to radical innovation with more substantial requirements in process and anchoring.

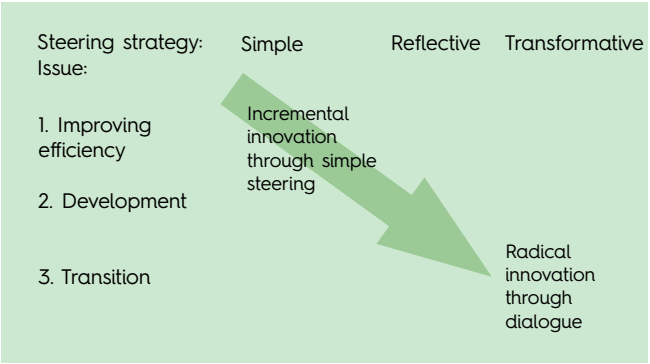


Figure 7-1: From individual interventions to radical innovation

This means that the climate challenge as a wicked problem has to be handled in practice through a diversity of interventions and processes in order to utilize existing opportunities. Many interventions can be handled through traditional objective- and result steering, but there will also be a need for a reinforced focus on transition (level III) and transformative processes. The climate challenge as a wicked problem is closely connected to our (contentious) mental models. Through making use of the opportunities that are sketched in Figure 7-1, it will also become clearer that the challenge is perhaps primarily to facilitate processes that become less contentious and more collaborative.

7.6 The municipality as a transition actor

The municipal sector has historically shown significant abilities to meet shifting societal challenges. This has also meant organizational transitions. However, the municipalities have only adapted leadership- and organizational development to a limited degree towards the challenge represented by the transition to a low-emissions society. Facilitating dialogue-based processes directed towards radical innovation can become a new and important task for the municipalities in the transition process. This requires that the municipalities develop for themselves a good understanding of the context where transition should happen. They need a conceptual foundation and mind-set to be prepared to organize and institutionalize their activities reasonably in relation to the transition (Selznick 1957).

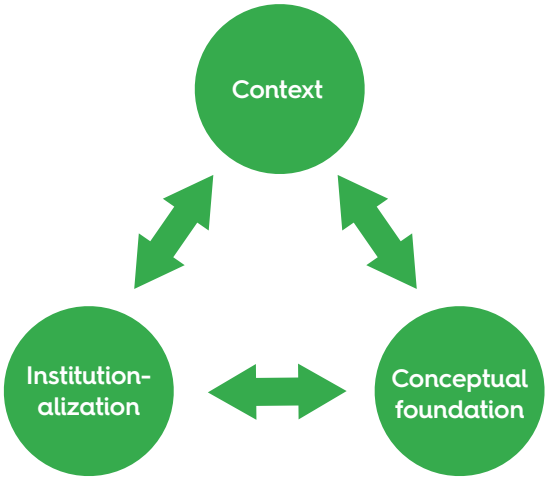


Figure 7-2: The relationship between context, conceptual foundation, and institutionalization (Selznick, 1957).

A part of the context is tied to how we experience the climate challenge, and in which manner we perceive that the question concerns us. It will become important for the municipalities to contribute to the development of unified contextual understandings that can form the bases for discussing conceptual foundations, municipality roles, and how institutions can be developed to contribute to the transition.

The process of reaching a common understanding of the context can also reveal the needs and objectives of different stakeholders, including which conflicting goals are experienced. This offers a starting point for dialogue about ways forward. Correspondingly, a good understanding of context can highlight whether there are institutions that should be developed or established.

Despite being able to identify both conflicting goals and other barriers for transition, we can reach more within today's frameworks – as shown by a significant stream of ongoing experiences, cases, ideas, and pioneer projects. This makes it also important to establish and further develop climate work in a manner that ensures the use of existing knowledge, experience, and technology. The municipality's role as a development actor should thereby be strengthened.

Examples of interventions in Oslo Municipality (see the following frame) illustrate that a transition to a low-emissions society demands collaboration between national, municipal, and private actors, and that across-party political anchoring through approving strategies and action plans. In addition, the implementation of concrete projects that incorporate the interventions is necessary to contribute along the way to a low-emissions society.

7.7 Institutionalization

Institutionalization implies looking at how different relationships are "set within a system." This means, for example, how responsibilities and roles are distributed (organization), how budget processes are organized, which funding schemes exist, which competence-development programs exist, and how these are organized[10]. Without systematic institutionalization, change processes can easily be limited to engagement and debate, rather than resulting in concrete outcomes.

Institutionalization has been important for handling societal challenges. Examples of institutions that have had, and continue to have, considerable significance for developing the public sector are Statoil, municipal real estate businesses, the energy law, inter-municipal water works, business cluster programs, urban environment agreements, research programs, educational offers, new national road business, and granting awards.

Institutions are important for setting themes on

10 Institutionalization encompasses norms for behavior, ways of thinking (common cultural foundations), or for devices such as laws, regulations, customs, responsibilities, and roles (organizing), funding schemes, programs, and projects, etc. Knowledge regarding what contributes to shaping structures that persist over time, i.e. what institutionalizes, is important. Tolbert and Zuckers (1996) look at institutionalization as a process from establishing structures in a field, building a consensus, and finally establishing fully legitimized routines and practices in an area.

Oslo municipality and the green shift

Oslo has ambitious climate objectives. The objectives are to halve the direct greenhouse gas emissions within 2030, and in 2050, Oslo's direct greenhouse gas emissions should be zero. Since the approval of the urban ecology programme and its first climate- and energy strategy in 2001, Oslo has had a red thread through their work, carrying them forward to a revised climate- and energy strategy in 2015. Cross-party political and administrative anchoring have been important and some critical measures taken include:

The climate- and energy strategy for Oslo is established as a roadmap for how the green shift in Oslo can be implemented to reach Oslo's climate objectives. Oslo municipal plan, "Oslo towards 2030 – Safe, Smart, and Green," describes a possible urban development moving forward towards a low-emissions society with densification and transit node development.

The climate and energy work in Oslo builds upon guidelines in the regional plan for Oslo and Akershus, approved in 2015. Through many years, Oslo and Akershus have collaborated to develop Ruter as a good and effective tool for prioritizing increased public transportation in the region. Ruter's strategy, "M2016," and efforts in emissions-free public transportation constitute important elements of the municipality's efforts towards a low-emissions society. The municipality's efforts received an extra boost through the renegotiated "Oslo package 3." The municipality partakes in the FutureBuilt programme, facilitating and implementing area renewals (i.e. Furuset neighbourhood development "smart suburb at the forefront"), and pioneer construction projects (i.e. Granstangen school). The municipality has had a strong focus on facilitating bicycling with a strategy whose implementation is the responsibility of a dedicated Director of Bicycling.

The examples of interventions in Oslo illustrate that a transition to a low-emissions society demands collaboration between state, municipal, and private actors, along with cross-party political anchoring through the approvals of strategies and action plans. In addition, transition requires the implementation of concrete projects, which integrate necessary interventions along the way to a low-emissions society.

the agenda and continue to be integrated in the municipalities' work. An example of the significance of institutionalization is the work towards developing climate-efficient solutions in the pioneer programme FutureBuilt, explained in the following frame. The programme is directed towards revealing pioneer projects within climate-friendly architecture and urban development, which have transferability to other municipalities beyond those involved in the programme.

Experiences from Norwegian municipal environment- and climate work (Chapter 3.3) and Difi (2014) indicate that the transition to a low-emissions society is weakly institutionalized. In particular, the experience from Local Agenda 21 work suggests that there is a need for municipal climate work to be less characterized by an enthusiast culture, and more for assurance based in structures, resources, and long-term thinking.

Since the climate challenge can be understood as a wicked problem with the need for more participatory, dialogue-based, and innovative processes, institutional development can be a good strategy (see the example in the frame on the right). The focus on institutionalization can be a key to pursuing, reinforcing, and initiating necessary transition processes. These can be processes that happen locally, regionally, nationally (for example through networks and programs), and internationally. Such processes will also reinforce each other.

City Environment Agreements 2.0?

The development of urban environment agreements in the direction of "transition agreements" can be an institutional development aimed at promoting the transition to the low-emissions society. This can help channel resources towards processes, piloting, R & D partnerships, etc., as well as towards developing infrastructure. Such an institution may also be an instrument for developing city centres' opportunities for local workers, local leisure activities, and increased use of urban and urban peripheral areas for local energy and food production.

The municipal sector can contribute to institutional development at all the levels and within different sectors directed towards transitioning to a low-emissions society. This also means developing and/or establishing institutions where the municipalities have limited roles. For example, the municipalities can contribute to setting up networks for businesses that deliver goods or services, which contribute to the transition to a low-emissions society.

The municipality's perception of its own conceptual foundation and roles will then be important for the extent that institutional development is seen as a part of the municipality's core tasks. Arendal and Tingvoll are examples of municipalities who have established processes that led to institutionalizing their climate policy, see the frame next page.

The FutureBuilt model

FutureBuilt is a 10-year programme collaboration (2010-2020) between 10 partners: Oslo, Bærum, Asker, and Drammen municipalities, Husbanken, Enova, the Ministry of Local Government and Modernization, the Directorate for Building Quality, the Green Building Alliance, and the National Association of Norwegian Architects. The programme is directed towards revealing pioneer projects within climate-friendly architecture and urban development. The daily work is driven by a secretariat, which consists of 5 people. The secretariat reports to a programme council that includes a representative for each of the 10 partners. FutureBuilt is a collaboration of host municipalities following the Local Government Act, and Oslo municipality is a host. At the bottom of the collaboration, there is a partnership agreement signed by all ten partners. Most of the partners contribute to the programme's funding.

In addition to the secretariat and programme council, FutureBuilt has a local organization in each municipality with local steering groups and a municipally employed project leader for FutureBuilt. This person works anywhere from 10-100% with FutureBuilt (dependent upon the municipality). The local steering groups decide which pioneer projects should be included in the programme. The programme has led to the realization of a series of pioneer projects, exemplifying how significant institutionalization is to the development of climate-efficient solutions. The programme also has a connection to urban development work in Drammen through anchoring the city's vision for becoming an environment- and competence- city, together with concrete projects.

Source: www.futurebuilt.no.

Institutionalization of climate policies in Arendal and Tingvoll

Both Arendal and Tingvoll municipalities are good examples of establishing processes which lead to the institutionalization of climate policy, and where institutionalization "sediments" this work (following Tolbert and Zucker's 1996 use of the term). These municipalities have established climate practices that can be seen as "sedimented" (Kasa and West Forest, 2016).

For many years, Arendal has had monthly meetings between the mayor, deputy mayor, city council, and environmental advisers to discuss their climate and environmental efforts. This contributes to even newly elected politicians coming quickly into the field and receiving an understanding of the local challenges, potential interventions, and instruments. They thereby achieve more continuity in the political arena.

Tingvoll has similarly established routines and practices that contribute to environmental policy becoming a priority area for policy change. The municipality has a politician school, which focuses on the environment, for all newly elected representatives in the municipal government. They also have a routine for handling all the relationships in the municipal council to ensure environmental assessments are made. It is always necessary to check off that assessments are made, and they say themselves that these are true assessments (Kasa og Vestskog 2016).

7.8 Ideological basis and roles

A municipality's ideology encompasses the ideas that unify the tasks the municipality has at all times. Since the establishment of the municipalities as an institution (Formannskapslovene, 1837), the municipalities have handled what has always been regarded as the most important common tasks. This has been fire protection, the establishment of social schemes, building infrastructure, law enforcement, welfare services delivery, community development, local business development, business operations, and various other, more situational challenges.

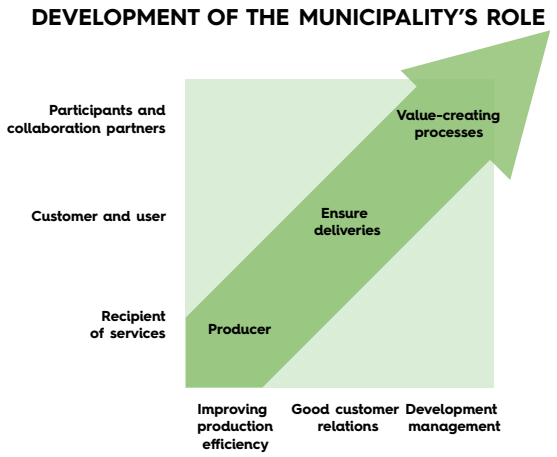


Figure 7-3: Development of the role of municipalities from producer of services to facilitator of value creation processes.

Figure 7-3 illustrates how the municipalities over the past 10 years have evolved from being producers of services to increasingly being organizations that ensure that users receive services of the right quality. This has happened through establishing a distinction between ordering and delivering services (the delivery of which, in many cases, has been competitively outsourced). However, there has also been a development of the municipality's role as a facilitator (organizer) for value-creation, through what is often called the municipality's societal development role, or the municipality as a societal actor. As Figure 7-3 shows, this is a development where organizations and individuals in the society are seen as participants and collaborators rather than users or customers.

The development of municipal environmental- and climate work has largely taken place within the conditions of a social development role. At the same time, experience with local climate work shows that there is both a need for, and a potential connected to, understanding the transition to the low-emissions society as part of the municipal context. This means that there will be a need for the municipalities to assess both the conceptual foundation of the municipality, and what the core tasks of their individual enterprises are.

For many municipalities, it may be appropriate to assume that their enterprises are carried out through the following roles:

1. **Development and operation of property, construction, and infrastructure.** Schools, kindergartens, care institutions, homes, roads, water and sewage facilities, outdoor recreation areas, etc.
2. **Management authority.** The Planning and Building Act is central, but other legislation and regulations are also relevant for the transition work.

3. **Service provider.** This also includes searching for and affecting the deliveries that happen through other actors.
4. **Owner of businesses.** These may be energy industries, real estate companies, catering etc. (fully or partially owned by municipalities).
5. **Societal actor through initiating and participating** in project- and network-management.

In the transition to a low-emissions society, the municipality's conceptual foundation and the different enterprises' roles and tasks must be discussed. This can be combined with institutional development (see Figure 7-2).

7.9 Collaboration-driven innovation

Since the late 1990s, open innovation processes (Chesbrough 2006) have become more common in business. The reason is that open innovation can increase competitiveness by providing both internal and external ideas that give a foundation for innovation.

There are many indications that the transition to a low-emissions society requires long-term collaboration and interaction between the municipality, residents, and other local stakeholders. The term co-creation is also used to denote that value is created through collaboration (Prahalad and Ramaswamy 2004b).

Sørensen and Torfing (2014) describe three key factors that are crucial for creating local innovations through collaboration-driven innovation:

- **Collaboration** and active participation because it promotes the exchange of information, knowledge, experience, and critical assessments. Municipalities can focus on coordinating individual actions and collective efforts, stimulating creative solutions and new forms of practice. This allows for critical processing and reformulation of solutions with an interdisciplinary basis.
- **Transformative learning** because it provides new insights, understandings, and ideas that can form the basis for developing new forms of practice, identity understanding, and stakeholder relations.
- **Joint ownership** because it reduces implementation resistance and promotes the spread of new, innovative ideas and practices. It also provides more sustainable solutions because the parties feel obliged to stand by and to defend innovative measures when they have participated in processes that are based on transparent norms and rules.

This means that the transition work in the municipalities can be based upon collaboration-driven innovation as a strategy. Such a strategy can be used in processes at the municipal level (visions, scenarios, future images, etc.), as well as in more specific efforts and projects.

Developer- or citizen- participation can be an important part of the work in collaboration-driven innovation by creating an understanding and acceptance for what should be done and revealing the logic behind action (Kallbekken and Aasen 2010; Tørnblad et. al. 2013).

Behaviour may, for example, be based on market logic or community logic depending on the activity one is involved in (Westskog et al. 2011, Gneezy and Rustchini 2000 , West Forest and Winther 2014). If one is encouraged to participate in the environment, one can think differently than if they are encouraged to think as much as possible about their own gain when decisions are made. Understanding such logics can be essential for dealing with the tools and interventions that are being introduced in the transition work.

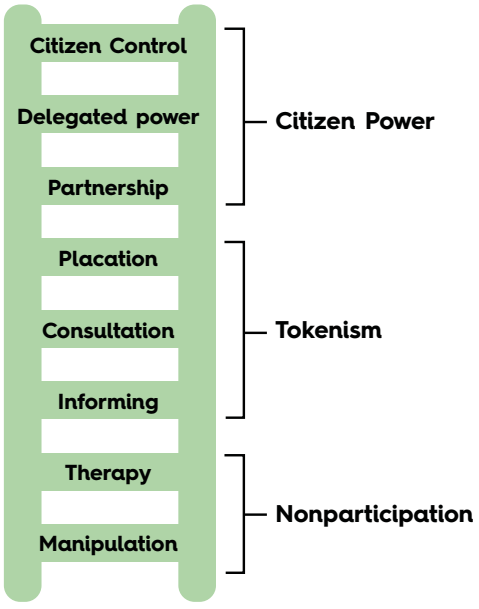


Figure 7-4: The participation ladder illustrates degrees of citizen involvement.

Citizens can be involved in processes and transition work to varying degrees. Arnstein's (1969) participation ladder, Figure 7-4, illustrates ranges of citizen involvement (see also Hanssen and Hovik 2013; Vabo et al 2004). The ladder is used as a metaphor for different degrees of participation. The bottom step represents the case with no participation, no contact between decision makers, and no citizen influence

over the decision-making processes, for example in the municipality. As you move the upwards on the ladder, the degree of involvement increases along with the degree of influence - from being informed and consulted to partnerships and the delegation of authority.

Collaboration-driven innovation is a strategy that allows for coordination between public, private, R&D, and NGO actors. Hansson (2014) describes this as developing an ecosystem for innovation where collaboration is developed between research, industry, and the public sector as a triple helix; collaboration where volunteer organizations and residents also participate is a penta helix, see Figure 7-5.

Collaborative innovation can further involve municipal enterprises and companies being invited into transition projects. This means that the municipal enterprises must develop their use of innovative public procurements.

The transition to a low-emissions society can increase the need for the municipal sector to be involved as a partner in research-, development-, and innovation-projects. This can be done, for example, through increased emphasis on user-driven programs and/or new interaction models between research and practice as outlined in Figure 7-6.

Collaboration-driven innovation is a strategy that can be used in municipal- or community development as well as in the development of the municipality as an organization. It is also a strategy that can strengthen contact the local society and regions have with actors outside of Norway.

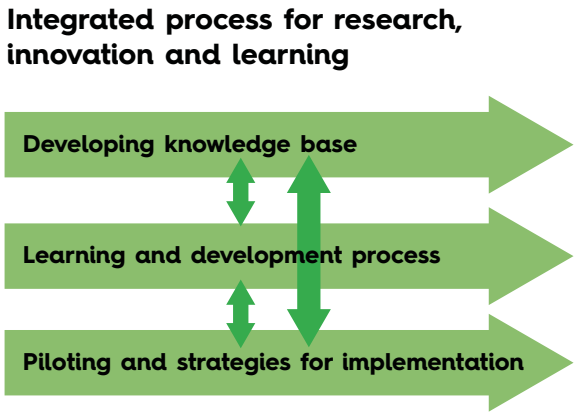


Figure 7-6: Integrated Process for Knowledge Development and Learning..

Three different examples of cooperation-driven innovation are illustrated in the frames below. Value-based and collaboration-driven transition in Malmö is a good example of how the transition to the low-emissions society requires safeguarding the climate perspective through many different projects, including projects that are not primarily conceived of as climate projects, but are projects whose effects contribute to the transition to a low-emissions society. The innovation arena Transport 2.0 is a regional innovation programme for research, innovation, and competence development for sustainable transport in Norway's west region (the axis of Oslo - Kongsberg). Climate Partners Hordaland is a network that aims to reduce greenhouse gas emissions and stimulate green societal- and business- development.

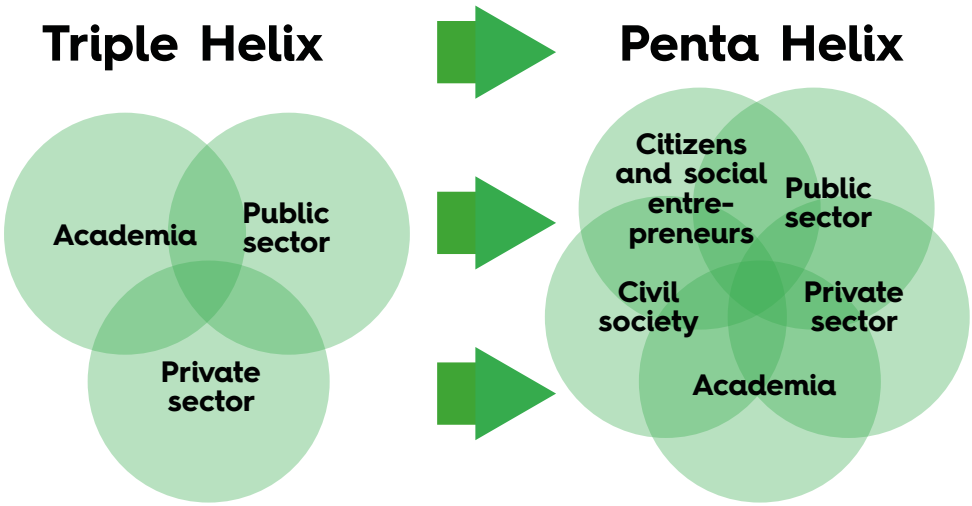


Figure 7-5: Ecosystem for Innovation

Malmö - Value-based and collaboration-driven transition

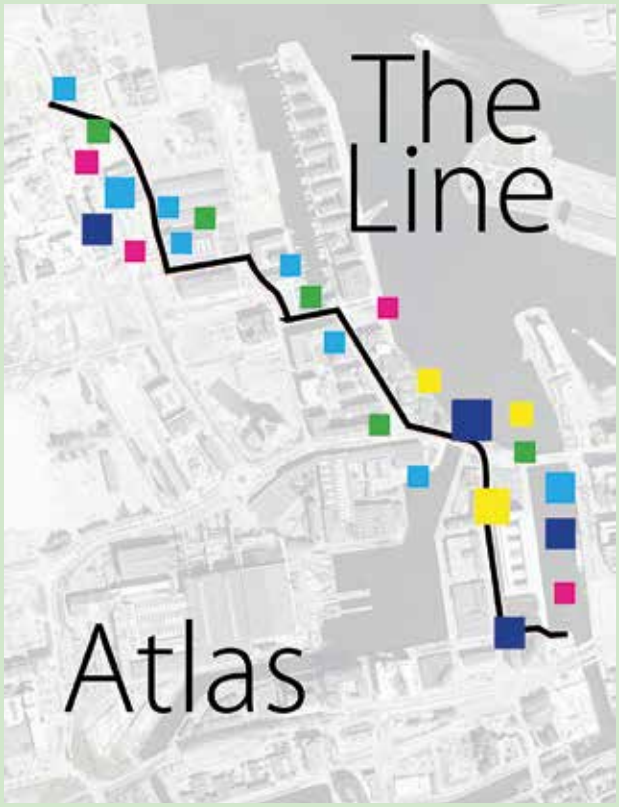
Malmö currently uses a value-based methodology in urban development, which places great importance upon values in a dialogue between municipality, developers, inhabitants, and other societal actors. A challenge in traditional urban planning is its production of solidified and detailed plans that are not flexible or capable of handling changes in presumptions. Traditional planning also has a focus on physical structures, which makes it easy to forget about the use, urban life, and people connected to them. The advantages of value-based planning are a fixed focus upon basic values and a flexible structure.

The western harbor (Västra Hamnen) in Malmö serves as a laboratory and a learning process for Malmö. It started with the Bo01 housing exhibition, which was planned at a time when the thought of sustainable development began to take off. Malmö has built further both upon good and bad experiences from Bo01 through the rest of the development of the western harbour and of other urban areas in Malmö. The municipality uses voluntary agreements regarding the environment, which use climate- and quality- objectives along with interventions as important tools. The use of "climate contracts" has thus become an instrument used by the municipality.

Other examples of innovative projects contribute in various relevant ways to more climate-efficient cities include:

- The Line: Sweden's first "urban axis" where shared economy is the basic principle.
- Nordic City Network: where Malmö has been central in developing political leadership in sustainable urban development.
- Developing a model for cooperation on physical urban development with a clear democratic approach. Based, among other things, on Arnstein's participation model (see Figure 7-4)
- Development of new financial instruments for sustainable urban development. This is an example of how Malmo looks at established budget/funding systems as institutions that can and should be developed in light of climate challenges. The project is part of the CSI Europe (Cities Sustainable Investment) network, and it is another example of how Malmo collaborates to develop new concepts and institutions.
- Innovation platform Malmö Southeast: which is a model for interaction between residents and other stakeholder groups. Malmö is an example of how a systematic and planning-based approach can be combined with strategic measures and innovative and open development projects. Malmö was ranked as the world's fourth most innovative city by Forbes in 2015.

Malmö illustrates that there can be a lot of different interventions that focus both directly and indirectly upon the transition to the low-emissions society. Malmö has attached great importance to orienting itself towards international development traits and trends in all aspects of sustainability. Malmö can therefore be seen as an example of a municipality that is strongly rooted in the climate challenge as a context, developing strategic measures and linking them to different forms of institutionalization (see Figure 7-2).



Malmö is an example of how the transition to the low-emissions society requires that the climate perspective is safeguarded across many different projects and tasks, including projects that are not primarily perceived as climate projects, but where projects effects contribute to the transition to a low-emissions society.

Innovation Arena Transport 2.0

Innovation Arena Transport 2.0 is a regional innovation programme for research, Innovation, and competence development for sustainable transport in Norway's western region (Vestregionen, the Oslo-Kongberg axis). The programme's partners are Vestregionen, the Buskerudby collaboration, Electric Mobility Norway, and SmartCity Bærum. The programme is based upon:

- The need for increased research and innovation in the field of transport to ensure good societal economy while meeting wellbeing, environmental, and climate challenges
- The need for business development that contributes to realizing Transport 2.0, including better integrating services (seamless travel) in order to compete with the flexibility of the private car
- The need for development of collaboration-driven innovation and user-driven research
- The need for a national pioneer region that can visualize the potential for both new transport solutions and collaboration forms.

The purpose is to stimulate wide-ranging collaborations across stakeholder groups regarding development projects directed towards the future and sustainable transport. The term Transport 2.0 aims to unify the programme's focus on innovation, research, and business development related to transport. Some key words:

- Shortest possible circuit, i.e. that the overall travel needs are least costly and resource intensive
- Transportation transfers that are optimized across different providers and means of transportation.
- Transportation that facilitates work and experiences while reducing "time costs".
- Optimal use of transport means, among other things, through the smart sharing of resources (carpooling and the like)
- Development of new organizational solutions and business models related to transport
- Transport as an integral part of urban development and place-making.
- Active involvement from business and public actors through interventions in their own organizations.
- Public actors reinforcing their role as a societal actors and facilitators.

Examples of ongoing innovation projects rooted in the programme include: Bicycle Library Drammen, Driverless Electric City Bus, Commute Greener (initiative in the transition to greener transport).

Examples of ongoing research projects anchored in the program include: car sharing (Vestregionen and TØI), green goods logistics (Byliv Drammen and TØI), Mobility and use of city centres for trade and activity.

(Vestregionen 2016)

Climate Partners Hordaland

Climate Partners Hordaland is a network established based on the experiences of Climate Partners Agder. The network aims to both reduce greenhouse gas emissions and stimulate green societal and business development. It is a public-private collaboration, coordinated by the Norwegian climate foundation. Climate Partners Hordaland was established in 2014 and has 21 members as of June 2016, including Hordaland County Council, County Governor of Hordaland, Bergen Municipality, Haukeland University Hospital, Sparebanken Vest, Asplan Viak, Atea, Grand Terminus, Bergen Energy, and the University of Bergen. The members undertake the development of the organization's carbon footprint, conduct environmental certification, and prepare plans to reduce greenhouse gas emissions. Furthermore, the members must pay a membership fee and the membership must be rooted in the highest management level within the organization.

This is an example of collaboration-driven innovation where the network creates meeting places for members where they can develop and promote green business ideas. The network will also disseminate climate knowledge and be an arena for climate debate, creating local, national and international interaction. The figures for 2015 show that members of Climate Partners Hordaland have cut their emissions and established targets for further cuts. Furthermore, the figures show an increase in the number of working hours and financial turnover for the member enterprises.

7.10 Catalytic leadership

In order to realize collaboration-driven innovation, there is a need to develop competences in leading and facilitating these types of processes. Such an approach requires different types of competences and a high degree of interdisciplinarity (transdiciplinarity) in the transition work.

Christiansen and Rathje (2015) use the expression "catalytic transition leadership", hereinafter referred to as catalytic leadership, for this type of management role. They have also studied this form of leadership in ProjectZero in Sønderborg, Denmark, which is aimed at the transition to a low-emissions society (see the frame below). Project Zero is an example of how a municipality has emphasized acting as a catalyst for transformation, where the goal is to develop a broad engagement and innovation culture across stakeholder groups and residents.

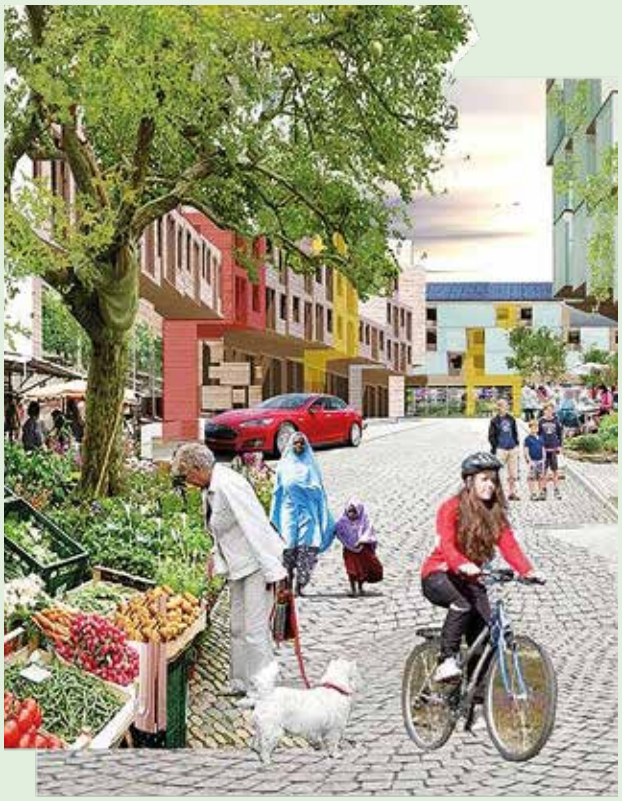
Catalytic management implies something paradoxical - that leaders get ahead by holding themselves in the background, i.e. leading by making sure that others take responsibility. This leadership strategy is effective because the transition to a low-emissions society must take place within a network context where both public projects and business development build upon many different contributions. At the same time, these processes are open and solutions can gradually emerge. In networks, there are often individuals or groups that can be motivated to take leadership responsibility.

Hurdal is an example of a municipality that has emphasized creating arenas, facilitating, and being a facilitator for initiating processes that can be followed up by others, such as local business. See the description in the frame below.

Experience with catalytic leadership points towards being a good model when it comes to contentious challenges, and where both issues and solutions need to be shaped through dialogue. This emphasizes the importance of:

- creating debate over visions and strategies.
- facilitating work locally while being in dialogue with national and global actors.
- having continuous innovation collaborations between industry, educational institutions, and the public sector (triple helix).

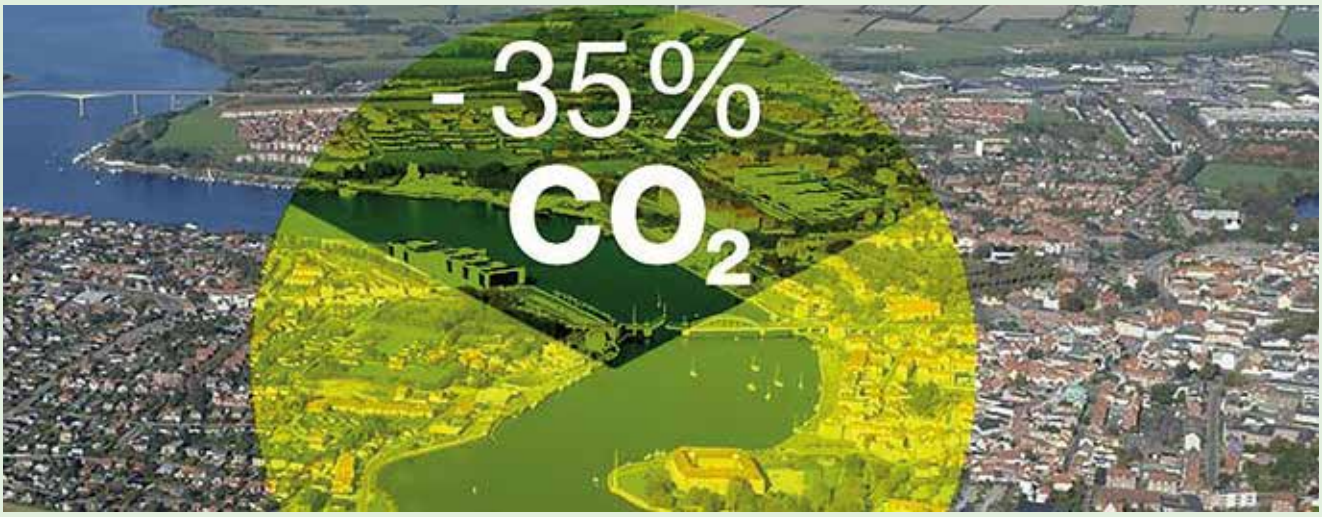
Hurdal and Project Zero are described below.



Illustrasjon Gro Hernes/Gaia

Hurdal "Energy-plus society 2025"

In 2014, a unanimous municipal council adopted a vision that Hurdal should become an "Energy-plus society," i.e. carbon-neutral or better by 2025. "We have chiselled out a direction for Hurdal," which has laid the foundation for sustainability (represented by the three pillars) to be assessed in all municipal council cases. The municipality also has council group meetings about sustainability approximately three times a year, where all the political parties in the municipality are represented. Various issues related to sustainability are discussed, but the management group has no decision-making authority. In the interviews, informants argue that Hurdal Municipality has been good at creating an arena, at facilitating, and at initiating processes that others, such as local businesses, can follow up. They emphasize that they see their task as a municipality as initiating contact and communicating between different parties in order to create arenas for value creation. They initiate and participate at the beginning of processes in a manner that allows them to withdraw later. They thus occupy a catalyst role in order to make change happen.



Project Zero in Sønderborg - catalyst for "The great transition"

Sønderborg Municipality in Denmark aims to become a CO2-neutral growth area 20 years before the rest of Denmark. ProjectZero has the vision of creating growth and new green jobs that contribute to the Sønderborg area becoming CO2-neutral by 2029. ProjectZero desires to pioneer ahead of Denmark and the rest of the world in terms of creating new growth through reducing CO2 emissions. Since 2007, 800 new green jobs have been created, and by the end of 2015, CO2 emissions have been reduced by 35%. The goal is to achieve a 50% reduction in 2020, and to be CO2 neutral in 2029. The foundation has been their Master Plan 2029 (2007) that offers an overall framework, and Roadmap2015, which outlines the first interim goals. Sønderborg has used Project Zero as a central catalyst for realizing its climate strategy. The project is based on the need to initiate and realize new business concepts through new collaboration forms for partnership. It also entails a strong focus on general competence development (knowledge, skills, and attitudes).

The vision is to create economic growth and new green jobs in the Sønderborg area based on the transition to a CO2-neutral society, also called "The Great Transition" based upon the region's own resources. Project Zero is thus an example of how both the municipality and those working in the project have prioritized acting as a catalyst for transition, where the goal is to develop a general engagement and an innovation culture across stakeholder groups and residents. Sønderborg has also prioritized distinguishing between strategic platform (Master Plan 2029) and concrete goals for different phases.

Through ProjectZero, CO2 emissions are calculated annually based on the principles established in the Master Plan 2029 and upon the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). Since 2007, total energy consumption has been reduced by 15% and energy production from solar cells has increased by 16% just since 2015. The municipality's continuous reductions also break the national trend of increased electricity consumption.

The results for 2015 are well ahead of the target development (25% reduction in CO2-emissions) and in connection with making these public, the mayor, Erik Lauritzen, emphasized that all groups and individuals have contributed to the success. He simultaneously warned against believing that the goal of CO2 neutrality can be achieved without continuous collaboration and new initiatives where all citizens and enterprises have a role. He emphasized how Sønderborg's efforts have opened new export opportunities and strengthened the business-related tourism industry in the region. Through Project Zero, the region has been granted 50 million Danish crowns from EU funds (SmartEnCity project), which increases their opportunities to accelerate the efforts (Project Zero 2016).

7.11 Strategy Development

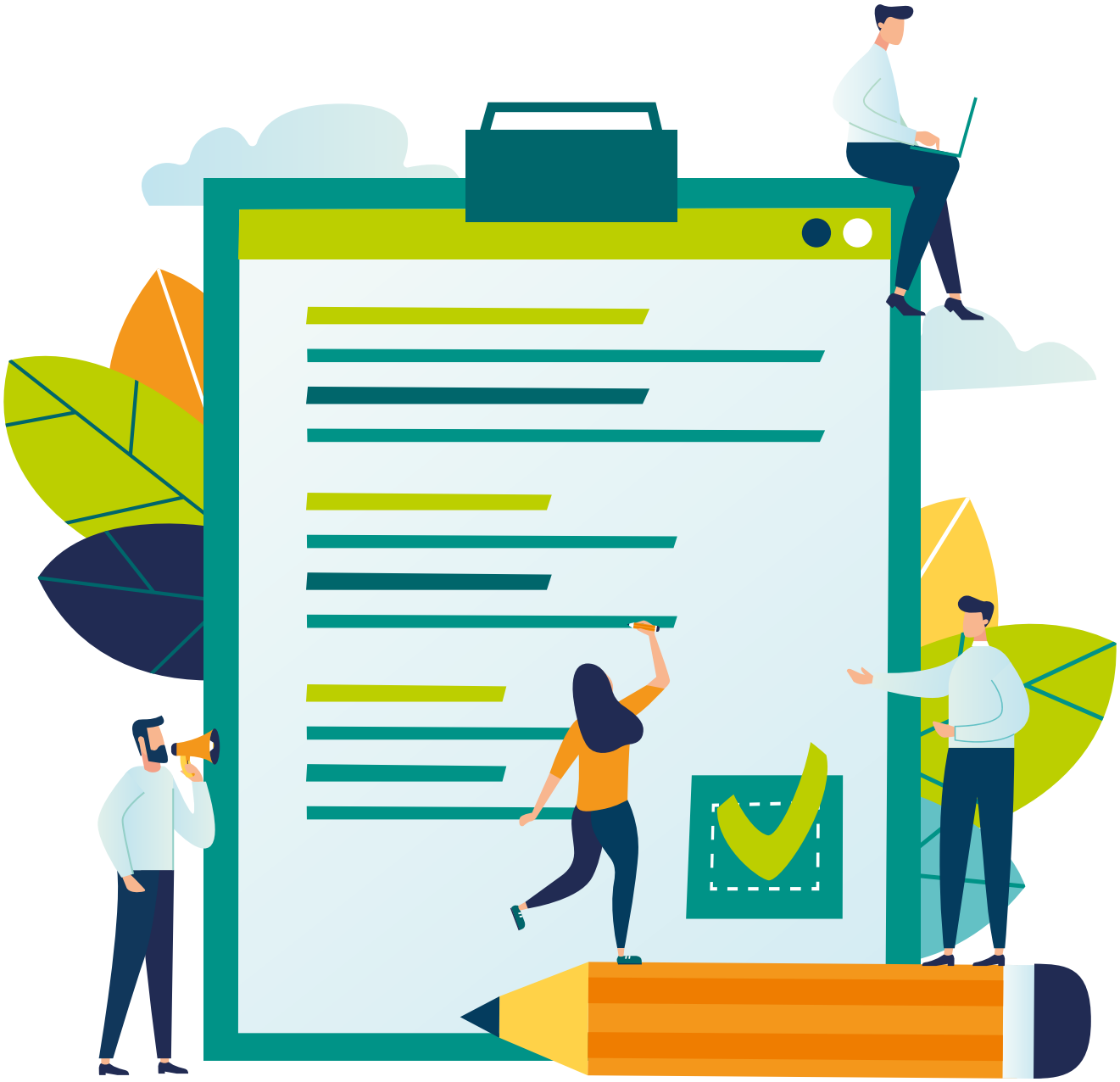
Common to many of the examples described in this report are: a form of political strategic platform, a comprehensive concept, and an anchored vision - all of which ground decision-making. Even though different terms are used, these can be understood as a "foundation", see Figure 7-2. The examples from Malmö, Drammen, and Sønderborg show that concrete plans have been developed based on strategic decisions, whether these are plans stipulated by the Planning and Building Act or stem from other forms of planning.

These kinds of strategic decisions form not only the basis for physical planning, but also enterprise- and business- development, organization of further work, funding, and other forms of institutionalization. In the transition to a low-emissions society, it may therefore be appropriate to distinguish between strategy development and planning. This distinction clarifies how different phases have different process needs, and different needs for political clarification and democratic anchoring.

From a norm-challenging perspective (see Chapter 7.1), one can say that the climate challenge has been framed in the same manner as far simpler challenges. As a result, climate change has been handled through "climate plans". What characterizes well-integrated ways to handle problems (i.e. planning) is that they are not often adequately problematized. If planning is based on presumptions that are rarely discussed, it can also be questioned. This can lead to a "more of the same" approach, rather than to innovative processes and solutions that address basic challenges (especially at level III). Experience with municipal climate- and energy plans also indicate that planning not only has limitations in resolving contentious problems, but that it becomes a problem in itself by hindering alternative approaches (Sandkjær in insam, 2015).

Problems can also appear solved, when in reality they are only diverted. According to Brunson (2003), this is a natural and efficient way to ensure the legitimacy of organizations when up against conflicting requirements. At the same time, Brunson assumes that it is more reasonable to secure the legitimacy to handle conflicts, rather than seeking, and being perceived to have, consistency. This is also in line with Galtung (2003), who points out how conflict management requires creative processes to lead to innovative (surmounting) effects. Mintzberg (1994) is also clear about the difference between strategy and plan. According to Mintzberg (1994), the function of planning is to give support during strategic processes, for example through developing good descriptions of the context. In principle, ideas and good strategic proposals can come from anyone, and there is no method proven as leading to the best strategy. Mintzberg (1994) clearly distinguishes between analysis (plan) and synthesis (strategy), pointing out that the leadership has responsibility for the latter.

Both the experiences with environmental and climate work and the examples above point towards it being appropriate to define the transition to a low-emissions society as a strategic challenge. Necessary planning at different levels and administrative management (such as regulatory plan processing and construction permitting) are more adapted to a clear strategy (strategic platform).



8. A new agenda

8.1 The main challenge

The transition to a low-emissions society can be seen as both a complex and contentious challenge. Therefore, it is a challenge for the municipal sector to establish a renewed agenda. To some extent, this involves "taking a step back" from many current local discussions, and putting new questions on the agenda. It may also be reasonable to question assumptions that have long been taken for granted in order to reach new assessments. The experience from environmental and climate work so far in the municipal sector and many of the examples described above show the great importance of the municipality as a transition actor.

This places increasing importance upon the municipality's role as a democratic societal actor and as a catalyst for change in local society - where as many as possible should be involved. This means that the political agenda should be formulated through processes that are both open and democratic, while at the same time targeting radically new solutions (radical innovation). In these processes, there will be a need for interaction with national authorities, business, NGOs, and other relevant societal actors.

The challenge for the municipal sector is largely linked to both the will and the ability to further develop its role as a driver and facilitator of collaboration-driven innovation for the transition to a low-emissions society. At the same time, many of the examples in the report and input from the informants point out that such a transition is not primarily motivated by realizing a society with less greenhouse gas emissions, but through further developing qualitatively good communities. This implies that the municipal sector should not primarily develop more plans, but that a political platform, which is both visionary and open to creativity, dialogue, and innovation, should be established - in each municipality and the municipal sector in general.

8.2 The local government's ambition level in the transition work

The municipalities have a great deal of freedom to choose their approach to the climate challenge. As a point of departure, the municipalities can choose just to follow the statutory tasks and frameworks imposed for their performance. At the same time, the municipalities, through their various roles (see Chapter 7.8), have great freedom to develop their role as societal actor, and to adapt it to relevant societal challenges. The municipalities therefore have a considerable opportunity and manoeuvrability to engage themselves in the transition to a low-emissions society.

Because climate challenges can be considered contentious, wicked problems, they will take a leading role in the transition process, likely requiring a very conscious prioritization and active political decisions in the municipalities. At the same time, the local government's involvement in the transition work both in Norway and internationally has led to their recognition as key players. This positioning is linked to the fact that municipalities and regions have close collaborative relationships in climate work with the population, local business communities, and NGOs. The municipal sector in Norway, at the same time, has a dialogue with national authorities on a general and overall basis. The municipal sector also has a significant international network, and as a whole holds great potential as a catalyst and partner in the transition to a low-emissions society. National authorities will therefore also be very dependent upon good interaction with the municipal sector in order to realize international and national climate policy objectives. Both the municipal sector and each municipality stand before a fundamental decision regarding their paths in the transition work.

This is related to the approach they base transition upon, which will reflect how the transition challenge is "framed." The following main alternative paths appear relevant:

- **Environment prioritization:** The climate challenge is seen as an "environmental question" that must compete for resources within a given framework, and which constitutes one of many requirements for which the municipalities are responsible.
- **Environmental efforts are profitable:** The municipality sees climate as an environmental challenge, but believes that "environment pays off," i.e., that climate-friendly projects are economically sound.
- **The low-emissions society requires targeted adaptation:** The climate challenge is seen as a fundamental change in context and that it is a local political responsibility to implement measures. The approach focuses on the goal of a "low-emissions society" and from ethical/ political basis, chooses to implement the necessary measures for reducing emissions.
- **The low-emissions society provides opportunities for local societal development:** The transition to the low-emissions society implies a context that offers new opportunities for developing local qualities. The vision and motivation for the transition is the development of local qualities. The focus is that projects and enterprises must also realize several important societal goals (business, housing, social and cultural development, employment, climate adaptation, etc.) and through those, strengthen the municipalities' financial sustainability. The low-emissions society is thus not an end in itself, but a necessary framework for a municipality that wishes to develop local qualities and value creation, and which also thinks globally by addressing indirect emissions.

Norwegian municipalities oversee a major area of responsibility, are significant economic actors, and have long experience with both societal development in general and climate work in particular. The Norwegian municipal sector also has an active role in, and is internationally recognized for, its environment- and climate work. Based on this, it should be favourable for the municipal sector to choose a high level of ambition in the transition to a low-emissions society.

8.3 Circular- and shared economy

A new agenda will probably require municipal sector discussion regarding basic local and regional economic preconditions. The transition that is necessary to realize a low-emissions society indicates that the starting point should be a circular-economical approach that is also closely linked to a shared- or collaborative economy (see chapter 4.4). This is a good starting point for local business development, and provides the basis for developing local competence and businesses, as well as new local and regional value chains and value networks.

A circular economics approach can provide a basis for a sustainable local- and regional economic development. At the same time, it is necessary to clarify more precisely what circular and sharing economies mean in practice, what effects (including emissions reductions) they can achieve, and what barriers exist for their realization. The framework for the circular economy, described in Chapter 4.4, can be a starting point for further development through practical experience and the establishment of a better knowledge base.

When it comes to waste management, the development of a circular approach where resources should initially be used by several (collaborating/ sharing) and/or for as long as possible has been underway for a long time. The amount of new resources to be extracted will be reduced by expanding upon this approach. For example, a waste policy based on the following prioritizations for resource utilization can be defined as a part of the circular economic approach:

- Multi-use, resources are used as intensively as possible and by the most people possible (preventing waste, minimum waste generation)
- Reuse, resources are used for the same purpose, possibly with adjustments (redesign)
- Reuse of materials (use materials from waste to make new products)
- Energy utilization (burn waste to reclaim heat energy)
- Residual waste that cannot be exploited is degraded with the smallest possible harm to people and nature.

The EU Commission's Policy Package on Circular Economics (2015) is directed towards a transition to a more circular, lifecycle-based economy that will contribute to increased competitiveness, promote

sustainable economic growth, and create new jobs. The policy package clearly points out that the municipal sector should also develop circular solutions that are not only related to waste and recycling, but also to providing an overall foundation for the transition to a sustainable economy.

To base the transition wok on a circular economic perspective, the municipalities can further develop their own waste policies, while also putting this thought into a larger perspective (see Figure 8-1). The figure shows what a circular economic approach entails together with the importance of economic activity being bound to natural and cultural contextual preconditions. This perspective can also have consequences in attitudes and values/identities taking a greater significance and in strengthening the possibility of good communal solutions rather than pure market economics solutions (Crompton and Boxes 2010)

An active further development of local and regional circular and shared economies will also strengthen the possibilities for a dialogue about what the basic assumptions (paradigms) should be for economic thinking and practice in general.

8.4 Collaboration-driven innovation

The examples in this report, show that there are many possibilities for implementing concrete interventions aimed towards the transition to a low-emissions society. Experiences show that it may be a good strategy to have both vision and a high ambition in terms of climate efficiency, but that projects that should be sustainable in sum must also incorporate many other qualities (i.e. universal design, working environment, urban life, social aspects, business development, health, climate adaptation, etc.).

In order to realize multiple objectives, there will often be a need to strengthen the quality of the development work by defining projects as development or innovation projects, and/or ensuring that all relevant perspectives are prioritized in their conceptual development and planning/engineering phases. This means that collaboration-driven innovation (see Chapter 7.9) may be a good approach for municipalities that choose a high level of ambition in the transition work.

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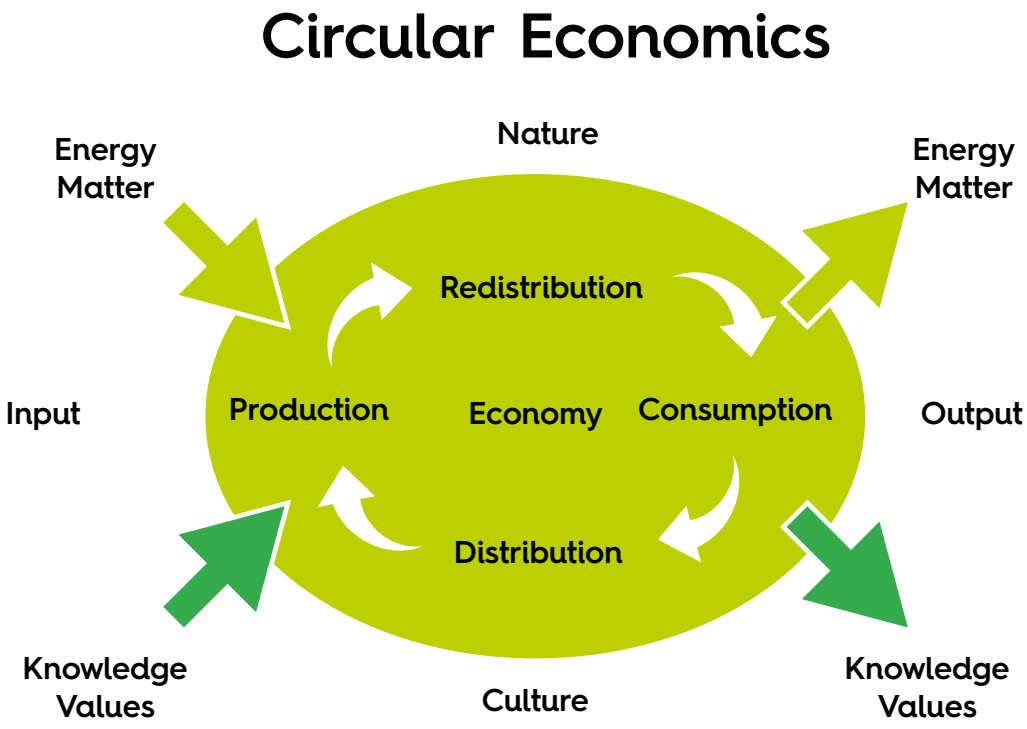

Figure 8-1: Circular Economics - Principle sketch, according to Jacobsen (2015).

8.5 A strategic foundation

According to Windsvold et al. (2015), local political leadership entails:

> *Creating targeted change in a way that gains support in the local society. Local political leadership can be exercised individually, by key politicians (such as the mayor), or collectively (by an entire municipal council together). Political leadership is exercised both internally, to the municipal administration, municipal employees, and the municipal council; and externally, to the population, teams and associations, and businesses.*

Such an understanding of political leadership entails that the transition to a low-emissions society may primarily be seen as a political leadership challenge in each municipality. It will be crucial that the municipal councils, with the support of administrative leadership, set the agenda in the transition work. An important issue for municipal councils will be to determine how the work on the transition to a low-emissions society should be developed. This also includes discussing their own roles against the necessity for participatory and open processes. Correspondingly, this will also open for elected officials to consider how they can develop their roles in the transition process.

Many of the examples in this report show "robust" principles or strategies that underpin a variety of concrete collaborative projects – and how these can be a good approach, rather than developing individual "Low-emissions plans."

Developing a common strategic foundation for the municipality or local society/region is thus a good opportunity for ensuring participation and engagement, and for formulating and discussing basic questions for the transition work. Such a foundation is also an opportunity to ensure broad and firm anchoring and understandings of context, both in respect to local relationships and to national and international development traits (see Chapter 4).

Developing such a strategic platform offers a good opportunity to discuss municipal approaches/ambition levels, and the significance of a circular economic approach. This phase provides an exciting chance to consider a variety of perspectives and development trends, and to establish a foundation for innovation through collaboration.

Other relevant questions that can be illuminated or addressed:

- Should "local quality" become a consistent principle that is sought after as realized in the most possible areas?
- Should the municipality base its own emissions upon its own enterprises, or rather upon the total emissions generated by the local society, or the total in the region, and should indirect emissions be included?
- Should a review of approved, but unrealized land area plans and construction projects be made - aimed at ensuring space for manoeuvrability, while avoiding the creation of guidelines that can increase (or "lock-in") emissions?
- How important it is to prioritize concrete action plans, rather than having a more open and inviting strategy where interventions are developed and realized continuously?
- How will the municipality both stimulate action and interventions in the short term while working to encourage new thinking in a longer perspective?
- Should future imagery (visions, utopias, scenarios) be established and, if so, what is important to emphasize?
- Is it appropriate to consider a strategy for "pioneer projects" where collaboration towards new solutions is stimulated?
- How important is work focused and targeted upon reducing emissions, rather than focusing on the need to develop local qualities (within a low-emissions context)?
- What are the most important themes to discuss locally and regionally in the transition work? A point of departure are the themes of construction, transportation, and food (see Chapter 5) and how these can be discussed within the frame of levels I, II, and III?
- How will the municipalities institutionalize (including organizing and funding) the transition process?

Based on a strategic platform, it will likely be reasonable to establish a temporary organization (enterprise area, project, program, network, or similar) with a mandate to lead and/or catalyse the transition work.

8.6 Regional restructuring processes

An important reason for establishing new, population-elected regions is the need to handle societal challenges in a more comprehensive way (NIBR, 2016). According to NIBR (2016), the new regions will, similar to municipalities, develop strategic platforms for the transition to a low-emissions society. This will be a good way of visualizing and making concrete what the following three dimensions in the role of societal development should safeguard (NIBR 2016):

- giving strategic direction,
- mobilizing the private sector/cultural sector/local society, and
- coordinating public efforts and instruments.

With this starting point, the people-elected regional level will develop a role that is very well suited to strengthening the work with collaboration-driven innovation, and in this manner can contribute to the transition to a low-emissions society.

8.7 Collaboration between the state and the municipal sector

The transition to a low-emissions society challenges established responsibility divisions and interaction patterns between the state and the municipal sector. In order to strengthen the municipalities' opportunities for transition through collaboration-driven innovation, arenas for dialogue and coordination between the state and the municipal sector are important.

Relevant themes relating to strengthening collaboration in the transition are::

- **Research and innovation.** The need to develop a research- and innovation policy during the municipal sector's transition work to a low-emissions society should be discussed further. A starting point is Innovation Norway, the Norwegian Research Council, and SIVA's common strategy (Innovationsstalen, 31.05.16), where many relevant societal challenges are brought up. Developing the use of public procurements directed towards the green shift and the transition to a low-emissions society will be relevant to discuss in this context. It is also shown by the description of Vinnova in the frame below.
- **Collaboration on realizing the potentials for emissions reductions at Level I (improving efficiency).** Many of the interventions are currently minimally controversial and relatively easy to implement. A coordinated implementation can be appropriate. Interventions can largely be implemented within current frameworks and technological opportunities.
- **The low-emissions perspective in the new municipal and regional structures.** The municipal sector can set up a process for discussing how a low-emissions society can be addressed within new municipal and regional structures. This can give an increased awareness of the potentials associated with the new structures.
- **Further development of land area- and transportation policies.** How co-ordinated construction, land area and transport planning can be further developed as a tool for conversion to a low-emissions society should be discussed. This may be central to addressing "local quality" and good integrated solutions. Such a discussion may also be relevant to the further development of established urban environment- and urban development agreements. Such discussions may also provide a basis for how the climate perspective should be integrated into choice of concept assessments for national investments (building and infrastructure). In the extension of such discussion, it will be appropriate to consider how the Planning and Building Act (PBA) can be developed as a means for transition (see Chapter 6.6)..
- **On the way towards a low-emissions society?** It is considered relevant to discuss plans/ methods for monitoring local and regional results (data bases, qualitative assessment, data collection, impact assessment, etc.) in order to establish a credible basis for performance reporting in collaborative projects (see the review of the Sønderborg example in Chapter 7.10).

Vinnova's strategic programme for collaboration-driven innovation

Vinnova is Sweden's innovation authority and it promotes collaboration between businesses, universities and colleges, research actors, and public sector enterprises. The government has presumed that societal demands should be met through more powerful collaborations between different societal actors. Vinnova's strategic cooperation program increases Sweden's innovation power for sustainable growth.

Vinnova wishes to make research more interaction and innovation-oriented through the use of triple helix projects. Through collaboration, research- and innovation environments are being utilized and meeting places are being developed with the aim of creating dialogue and laying the foundations for new collaborative relationships. The programs are based on collaboration-driven innovation, and both municipalities and regions are important partners who provide a basis for not moving R&D activity out of Sweden. Vinnova manages a series of strategic programs that are interdisciplinary and address societal challenges, for example within transportation. The programs are chosen from business needs and interests, including the possibilities for the international market, i.e. connecting to global challenges such as sustainable transportation. The public sector can therefore have a catalytic effect on green capital in business, and contribute to ensuring adequate funding overall. It is considered desirable that the municipalities involve more and more employees and citizens in such innovation processes. This presumes that public actors develop collaboration with private actors, NGOs, and academics. The public should be a driving force and facilitator for both the development and application of innovations.

Examples of programs include:

- **Next generation** travel and transportation aimed at increased exports and reduced climate strain.
- **Smart cities** focusing on environmental and climate technologies, smart electrical grid and the digitalization of the urban environment.
- **Circular bio-based economy** aimed at replacing fossil products with resource-efficient reuse and recycling.

Vinnova is also working to develop itself as a partner for the business and public sectors in these types of innovation programs.

It is considered important to conduct smaller parallel development works in the municipal sector, and to help develop solutions that can be used by multiple municipalities. Innovation arenas are catalytic meeting places for all players in the triple helix field. Another important tool is innovative procurement. The figure below illustrates the prioritization of basing research and development tasks upon principles and concepts.

VINNOVA
Sveriges innovationsmyndighet

8.8 International processes

The climate summit in Paris (2015) demonstrated the importance of the municipal sector's work being recognized as an independent political level. In the future, the municipal sectors, both internationally and in individual countries, can be given more important roles in the transition to a low-emissions society.

The municipal sector in Norway has long played an important role in international climate work, allowing Norway to reap important lessons learned from other countries.

The overview of challenges and opportunities, key principles for realizing innovation and transition, as well as the examples presented in this report, lead to the question of what should be done in the future? This applies simultaneously for individual municipalities, regions, and municipal sector in general.

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