NORWAY

AUTHOR

Professor Thomas Berker, PhD
Department of Interdisciplinary Studies of Culture, Norwegian University of Science and Technology 7491 Trondheim
E: thomas.berker@ntnu.no

1 OVERVIEW OF THE REGION

Trondheim municipality, located some 400 kilometers north of the capital Oslo, covers an area of 342 km^2 with a population of 180,000. It is the third largest of 428 Norwegian municipalities that are grouped into 19 administrative regions called counties. Trondheim municipality contributes roughly two thirds to the population to the surrounding county, Sør-Trøndelag. In terms of area and population the municipality corresponds roughly to the city of Trondheim.

The GDP of Sør-Trøndelag county was estimated to be €42,000 per capita in 2011, which was just below the average in Norway. The county produces 4.3% of the national GDP which is far below the off-shore industry (24.4 %) and somewhat below the capital region (Oslo: 16.1 %) and regions with a high concentration of oil industry (Rogaland and Hordaland that contributed 7.7 % each, (SSB 2013).

Total stationary household energy consumption in Trondheim municipality in 2009 was 1.3 TWh, which corresponded to 7.8 MWh per inhabitant and was just below the average in Norway (9.4 MWh, source SSB 2011a). Energy consumption in Trondheim municipality by fuel type (Gwh, 2009, source SSB 2011b)

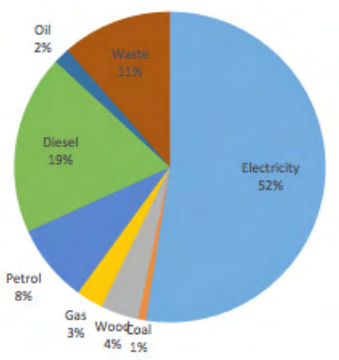

Figure 1 – Energy consumption in Trondheim municipality by fuel type (Gwh, 2009, source SSB 2011b)

Total energy consumption in the municipality is roughly divided equally between the service sector, households, industry and transport.

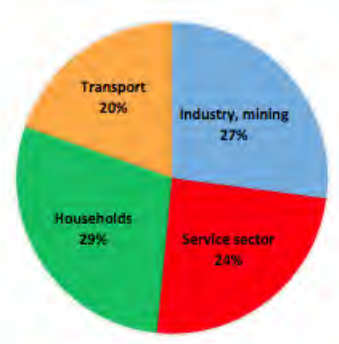

Figure 2 – Energy consumption in Trondheim municipality by sector (GWh, 2009, source SSB 2011b)

More than half of the total energy consumed in the municipality comes from electricity. The GHG emission factor for electricity from grid is in theory zero since Norway covers its electricity demand almost completely by domestic hydropower. Since Norway is part of the common Nordic electricity market (NorPool), the actual factor varies according to the degree of cross-border trading. For instance, a total factor of 0.033 kg CO_2eq/kWh (2010) was estimated for October 2010 based

on data from the Norwegian Water Resources and Energy Directorate (Klimakalkulatoren 2010).

The total emissions from Norwegian territory was 52.7 million tons CO_2 equivalent emissions in 2012. Approximately one quarter of this is related to oil and gas production (which corresponds to the offshore contribution to the GDP). A further 19% is caused by road traffic (SSB 2014).

2. CURRENT SITUATION: TARGETS RELATED TO ENERGY POLICY

In 2012, a common market for electricity certificates between Norway and Sweden was established. In this program, both countries have committed to finance 13.2 TWh renewable electricity, no matter where there are produced. Power producers receive one certificate for every MWh of renewable electricity generated.

A market is created through the fact that energy suppliers are required by law to buy certificates that correspond to the amount of electricity they sell. This scheme which is meant to encourage local renewable energy production on the Norwegian side has led to concerns that an oversupply of (not only) renewable energy may lead to low prices. This is usually countered by the general argument for energy efficiency in Norway which is to use as much as possible of the zero emission electricity produced by hydro power plants (and other additional renewable sources such as wind) to substitute other emission intensive activities.

A typical example for this strategy is the efforts to electrify the offshore industry through offshore wind farms (Øyslebø and Korpås 2011). On the smaller scale of a municipality, an example from Trondheim is a project with the aim to electrify the municipality's car pool. Electric cars in general are subsidised rather heavily in Norway through generous tax breaks, no annual registration fees, free parking at municipal parking spaces, and no road charges (that are quite common).

This made the most popular EV, the Nissan Leaf, the most sold new car in January 2014 (5.7% of 11,385 newly registered cars).

Another example for the substitution strategy is the planning process for the Brøset area with its "holistic" focus on emissions connected to the whole of everyday life is another example (case study as described below).

There are no official quantitative targets for energy or emissions reduction set for the region. However, the so-called Lian declaration (2007) commits the centre-left coalition government of the municipality "to be one of the drivers for GHG reduction and sustainable development" and to strive for "a better political control of the urban development" which includes the "municipal ownership of the development areas".

Norway has adopted a policy of incrementally increasing energy performance demands in the built environment. According to a government white paper from 2012, the next revision (to be implemented in 2015) will include requirements that correspond to "passive house levels". Even though the exact definition of "passive house levels" is discussed controversially (Müller and Berker 2012) this would be a considerable step forward from the current minimal requirements that allow for mutual compensation for instance between maximum window area of 20% of the heated floor area and a U-value of 1.2 W/m^2K. That means that the window area can be increased if the U-value is adapted correspondingly. Moreover, the mandatory use of district heating (based mainly on waste incineration) for newly developed housing areas is currently under discussion.

Trondheim's population is growing rapidly, as is the case with all urban regions in Norway. This growth has led to a pressure to develop new housing areas. Besides this population growth, regional drivers for energy and emission reduction specific to the municipality and the surrounding Sør-Trøndelag county are intermittent energy "shortages" that produce higher electricity prices for short periods of time. In the past these were caused by low precipitation in conjunction with some energy

production facilities (e.g. Swedish nuclear power plants) being temporarily off-line. In addition, Trondheim municipality hosts Norway's only technical university and Scandinavia's largest private research institution (Sintef). This gives the region abundant access to engineering expertise.

3. CASE STUDY: THE BRØSET NEIGHBOURHOOD

The case study presented here is an example for an ambitious partnership between the municipality, the state housing bank of Norway and the local university and research institutions harnessing local drivers for the development of a new neighbourhood in Trondheim. The Brøset area is one of the few areas for significant new housing development (regulated for some 4000 inhabitants) that is relatively close to the city centre (ca. four km distance). The area which covers 35ha is owned partially by Statsbygg (the Norwegian Public Construction and Property Management Organisation) and South Trøndelag county. The area is now used for agriculture and a psychiatric clinic but it has been regulated for development as housing for many years already.

Objectives and methods

The main goal of the Brøset development is the reduction of per capita GHG emissions to approximately one third of 2012 levels. Given the pressure to develop new housing in all Norwegian urban areas the Brøset case is also a pilot for sustainable planning and construction in Norway in general. This role is formalised in Brøset's central role in the Norwegian "Cities of the future" network that is funded by the Norwegian government.

An overarching focus of the research this case study is part of ("Towards carbon neutral settlements" funded by the Research Council of Norway within the Renergi program) was to study and change current planning and design processes in order to enable more ambitious environmental goals. This is based on the observation that high environmental ambitions that break with standard expectations for urban development tend to be sidelined during standard planning processes.
The case study employed methods such as research interviews with both experts and future users of the area, energy and waste, mobility and architectural modeling in order to identify specific potentials and solutions for the area. The work was organised in an interdisciplinary way involving architects, engineers and social scientists. The active involvement of the researchers in the municipality's work and of the municipality's representatives in research meetings added an action research dimension to the project. Observations gathered in this very time consuming aspect – one researcher participated in virtually all relevant meetings at the municipality - are published by Gansmo (2012).

The case study started by exploring and subsequently defining environmental objectives in a holistic but at the same time also evidence-based way. The master plan from 2013 defines them as follows:

1. environmental consequences should have to be explored and documented systematically and continually during planning, construction and operation;
2. energy consumption in the building stock should be at least CO_2 neutral in order to compensate for other sources of GHG emissions (transport etc.);
3. buildings and infrastructure should be organised so that energy consumption is minimised;
4. passive energy design should be used. Use of sun radiation and protection against wind is to be optimised;
5. a LCA focusing on GHG emissions is to be conducted; Waste has to be measured and priced for every household; an extended participation process during the whole development has to be sustained.

In 2011 an open and parallel planning competition' was held. Diverging from traditional practice, four teams, together with researchers, produced four alternative visions of the areas future shape and functions. These visions then were broadly discussed by the local public (for presentations of the results see: http://www.skyscrapercity.com/showthread.php?p=73964009).

After this competition was held a master plan was developed and an additional research project in 2012 helped to establish an experimental pavilion which is surrounded by areas used for urban agriculture. In this project the results of the planning competition were presented on-site and group discussions were conducted with prospective users of the area in order to explore a wide array of possible green lifestyles.

Results and outcomes

Especially the "open and parallel" planning competition that focused on knowledge transfer between academia, municipality and competition participants – instead of competition – marks a clear deviation from the business-as-usual approach to municipal planning. It is reasonable to assume that the main outcome of the processes surrounding the Brøset development so far is learning among the participants about alternative planning strategies for the realisation of high environmental goals. The whole process was supported strongly by active individuals at all levels within the municipality both in administrative and the political branches. Without this engagement that went far beyond business-as-usual involvement the ambitious Brøset development would not have come as far as it has today.

Despite this progress, the researchers also encountered a series of challenges. In the course of the four years that the researchers accompanied the process within the municipality there was considerable exchange of participants. At one point the supportive leader of the relevant authority within the municipality left for another job and the individuals that are in charge of the process now (in 2014) belong to a completely different department. When individuals leave the project, when new individuals are added, and when a project shifts between departments within the organisation, knowledge gained may spread to new projects, and new participants may add new insights. However, these fluctuations may also endanger continuity within the development process, which is particularly dangerous when the standard way of doing things is left in favour of the exploration of innovative ways. In this situation the involvement of the researchers is a valuable asset – even though the individuals within this group shift as well according to academic rhythms (e.g. PhD and postdoc cycles and funding periods).

Another challenge that emerged during the process was the shared ownership of the area. The political process to get all owners in line with the municipality took a long time and is not completed at the time of this writing (February 2014). For instance, for a long time the owners signaled that they would not accept loosing money because of high environmental goals of the development. This shows that administrative and political support at the level of the municipality is important but not sufficient. In this case the concerted action of a national actor, the land owner Statsbygg, a regional entity, the other land owner Sør-Trøndelag county and the local municpality would have significantly improved the chances to translate regional planning with high environmental ambitions into an actual low carbon neighborhood.

4. CONCLUSIONS

The Brøset case covers the early planning of a low carbon neighbourhood. The commitment to alternative planning processes has created a promising starting point but faces an uncertain future. Whether conventional implementation processes will be used or innovative alternatives will be sought is open and this will impact on the future of the neighbourhood. Brøset may very well end up as another example where widely published ambitions leave hardly any mark on the resulting neighbourhood. However, the process thus far has kept the door open for these ambitious alternatives and this is probably as much as can be expected from a planning process for a low carbon neighbourhood. In this sense the experiences made should be transferable to other municpalities in Norway and beyond. A continuation of the close collaboration between municipality and researchers in a research context with broad public engagement would encourage a positive development.

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The COST Action TU1104 Smart Energy Regions brings together over 70 researchers from European institutions to investigate the drivers and barriers that may impact on the large scale implementation of low carbon technologies in the built environment. The book "Smart Energy Regions" is the outcome of the Working Group 1 of the Action and collects analysis and case studies from 26 European countries. For more information about the Action and COST please visit www.smart-er.eu and www.cost.eu.

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COST DESCRIPTION

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