From Paris to local government action: implementing territorial carbon budgets

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Abstract

The Paris agreement states that the signees have a shared responsibility of limiting global temperature increase to well below 2.0, and aim for 1.5 degrees. Acknowledging that a major percentage of global warming stems from energy related carbon dioxide emissions, a method has been developed for expressing the global temperature goal as local territorial carbon budgets. We argue that the method is novel in three ways; it provides a bridge between a global temperature target and a local emission pathway; it inherently communicates the fact that fossil carbon emissions are cumulative to their nature, implying that the current paradigm of setting climate targets is flawed; and it gives fuel to the discussion on sufficiency due to the combination of the high calculated reduction rates the method generates, and how emissions are distributed among countries and people.

To be effective in contributing to the Paris climate goals, carbon budgets need to be implemented on a large scale while retaining depth in context. The aim of this paper is to enquire into the conditions for implementing the Carbon Budget (CB) framework into municipal practice. Using Kotter's theory of change and the conceptual framework on scaling-as-learning, we understand implementation as a change process, integrating and adapting certain content in practice.

Consisting of three parts, the paper first introduces the CB framework and describes its application and possible interpretations by local stakeholders in a municipal setting. Second, we draw on the change theory to explore change conditions needed for a successful implementation. Finally, we outline processes guided by the conceptual framework of scaling-as-learning as possible support mechanisms for the change conditions of this implementation.

Introduction

One of the ultimate goals for the energy efficiency agenda is to curb climate change. According to the Paris agreement (Paris Agreement 2015) we should strive to limit climate change to 1.5 degrees above pre-industrial levels, at which there are already severe effects, e.g. as outlined by the latest IPCC report, SR15. Now, post-Katowice, there is still no political agreement on how to equitably distribute, as the Paris agreement states, the emission reductions needed to reach the temperature goal. However, Anderson and Bows (2011), have suggested a framework for going from a global carbon budget to local carbon budgets. As an established concept, the carbon budget is used by the Intergovernmental Panel on Climate Change (IPCC) among other actors and institutions. The Carbon Budget (CB) framework has gained traction predominantly in the UK and is now part of the British and Scottish climate legislation. In November 2018, Manchester approved a policy[1] for a year-to-year emissions reduction of 13 % p.a. commencing in 2018. As Manchester city, as of writing and to our knowledge, is the only public body that has adopted a stringent CB framework, there are no studies yet that cover success factors or describe

1. https://www.manchester.gov.uk/news/article/8076/ambitious_climate_change_target_proposed_for_manchester

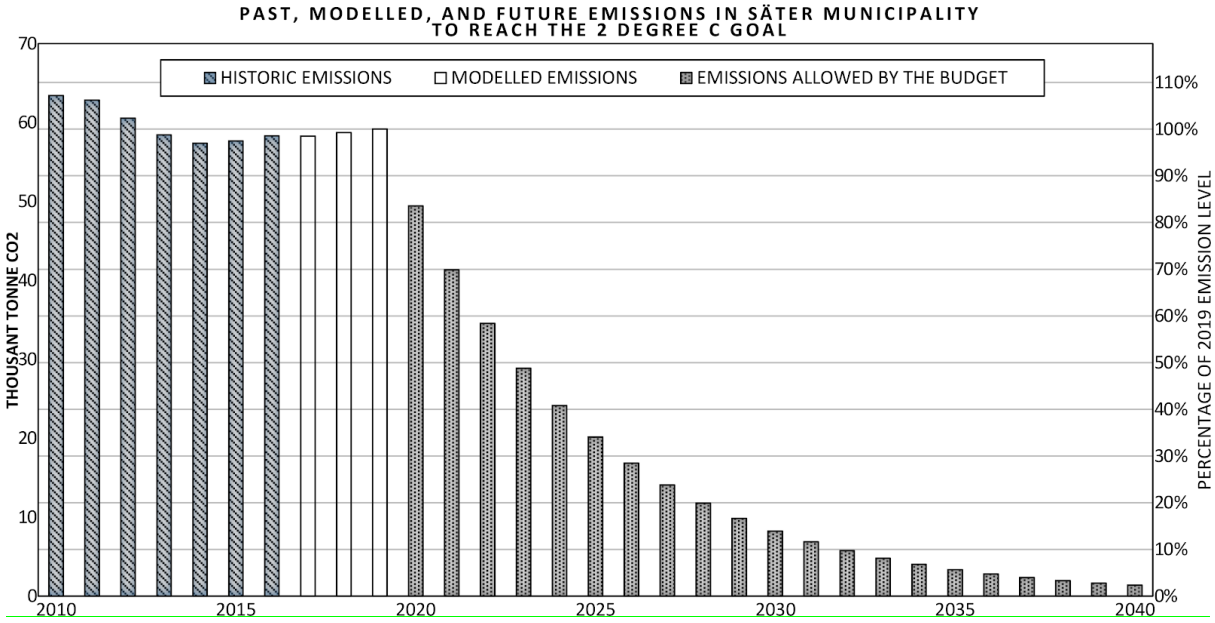

Figure 1. The bars show historic emission (2010–2016), modelled emissions (2017–2019) and an emission scenario for post 2019 for Säter municipality in Sweden to stay within its share of CO_2 emissions, i.e. within its carbon budget. Based on data from (Andersson, Schrage, Stoddard, Tuckey and Wetterstedt 2018).

the political process that took place to get it in place. However, we presume that there were conflicting interests in this, coming from perceived conflicts between different sustainability aspects, e.g. economic, environmental and social. Additionally, carbon budgets have recently become part of EU-legislation[2] albeit without binding targets, and are being calculated for a number of Swedish municipalities and regions[3]. The recent Exponential Climate Action Roadmap[4] is also based on the global carbon budget.

The (global) carbon budget is the amount of carbon dioxide left in the atmosphere to stay below a certain global temperature increase, e.g. 1.5 or 2.0 °C, as measured relative to the pre-industrial era. Effectively, the size of the carbon budget depends on future emissions of other greenhouse gases (GHGs), such as methane and nitrous oxide, for which scenarios need to be made in order to determine the carbon budget.

The Paris agreement states that we should "hold the increase in global average temperature to well below 2.0 °C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 °C". In doing so there are "… common but differentiated responsibilities and respective capabilities, in the light of different national circumstances" and that the signees agree "… to undertake rapid reductions according to best science and … on the basis of equity".

The scheme of CB suggested by Anderson and Bows for equitably apportioning the global carbon budget all the way down to municipal level relies on two founding principles: accumulated historical present day emissions are not evenly distributed between countries (cfr. the Global Carbon Project[5]), and, the possibility of taking action to reduce emissions depends on economic capabilities. On the global level, the framework differentiates between industrialising (non-OECD) and industrialised (OECD) countries, apportioning the former a larger share and even allowing them to increase their emissions for a few years. Industrialised countries however, instantly need to decrease emissions.

From that point, carbon budgets can be calculated for groups of countries (e.g. EU), and afterwards apportioned to nations and even regions and municipalities.

Once the total budget is calculated it is divided into annual budgets for every year from now and into the future, making sure the total stays within the apportioned budget. Every realistic possible emission curve needs to consider current emission levels so that the decrease does not become too abrupt. The suggested way of doing this is by applying a fixed annual percentage decrease. An example from applying the CB framework to the municipality of Säter, Sweden is shown in Figure 1. As calculated using the framework, the reduction rates needed are for OECD-countries about 15 % p.a.[6]

We believe that the CB framework is an important step in breaking down the Paris agreement to the local level where considerable change is happening, and that it will strengthen the work already in progress, contributing in the following three ways:

First, it provides a *scientific way* of coupling the global temperature goals, put down in the Paris agreement, to local meas-

2. http://www.europarl.europa.eu/doceo/document/A-8-2017-0402-AM-324-324_EN.pdf?redirect)

3. http://www.climatechangeleadership.se/category/carbon-budget/

4. https://exponentialroadmap.org/wp-content/uploads/2018/09/Exponential-Climate-Action-Roadmap-September-2018.pdf

5. https://www.globalcarbonproject.org/

6. Coarse estimate based on the Manchester (13 % p.a.) and Swedish reports (16 % p.a.). As the CB is rapidly used up, published values quickly become obsolete.

urable quantities, which can easily be used as goals/targets on every level in society.

Second, it helps in bringing attention to the fact that fossil carbon emissions are a *cumulative problem*, such that what was emitted previous years makes the room for future emissions smaller. As such, it provides a criticism to the current way of setting and presenting climate targets, e.g. the EU 2030 emission level targets set to be 40 % lower than 1990. A future emission target, without a defined emission pathway, may or may not stay within a CB, and therefore may or may not be sufficient for meeting the goals in the Paris agreement. It simply provides too few constraints on how the cumulative fossil emissions will develop over time.

Third, it supports the notion of *energy sufficiency*. At the state we are in, with CO_2 concentrations reaching approximately 410 ppm[7], the CB framework may provide an entry point to the discussion on sufficiency. The scheme for equitably apportioning local CBs from the global CB takes three aspects into account; the fact that global emissions globally are, and have historically been, highly skewed, meaning that some countries have emitted much more than others.[8, 9] This also holds for emissions within countries, i.e., in general, the richer the person, the higher the emissions. Further, countries or regions with higher GDP are assumed to have greater possibilities for decreasing emissions in percentage of current emissions. In addition, because of the high rate of emission reductions needed as calculated by the CB framework, the viewpoint of sufficiency is the only meaningful starting point for what to aim for. Taken together, the aspects of sufficiency both mean that since a lot of people cause high emissions because of their consumption, they are the ones that need to decrease their consumption to sufficiency levels – which is a parallel to the reasoning in the CB framework. At the same time, those with low emissions, possibly at sub-sufficiency levels, may increase their emissions for a short period of time until better technology is in place – also paralleled by the design of the CB framework. When turned into action, it will ask for sufficiency to be explored, in order to identify emission reductions that avoid or limit negative social consequences.

We believe that a CB could be adopted by a municipality in multiple ways in terms of interpreting the content of the CB framework in a local context. Commitment could be measured on a scale ranging from being filed as a document, but not acted upon, to being set as the overall master plan for the municipality's undertaking including dictating the monetary budget. The way the CBs are expressed, they include all territorial emissions, therefore including emissions also from activities of companies and citizens not under the direct control of the municipality.

In the text below we will consider one extreme of the adoption scale, i.e. that the municipality both for its own organization, as well as for the geographical area it belongs to, puts the CB goal on the same level of importance as the economic budget. Arguably, it is only then that the sufficiency argument will be needed, and then that the notion of sufficiency will help in accepting the change needed to reach the goal.

While there could be diversity in how a CB is adopted, there is a core proposition regarding principles and methods forming a content of the CB framework. An example of this is that emissions are to be understood in a cumulative way, instead of as is often done today, as annual emissions. Today, CO_2 emissions are usually reported yearly, in the same way as energy use, air pollutants, etc. However, the global carbon budget, reflecting the long-term challenge of climate change, is not limited to the annual perspective – it is a budget for many years to come, that can be broken down into yearly budgets. Thus, the "content" of the budget, in the sense of a proposition that is made and co-created to have meaning in practice, implicates more than just the numbers presented.

Aim and outline of the paper

We will in this paper enquire into the conditions for implementing the CB framework into municipal practice. Using Kotter's theory of change (Kotter 1995), and the conceptual framework on scaling-as-learning (Mickelsson, Kronlid and Lotz-Sisitka 2018), we understand implementation as a process of integrating a certain content (methods, facts, principles) into municipal practice. Implementation, as the integrating of content into practices, is further understood qualitatively as a deep change of ongoing practice in the municipality enabled by critical reflection among municipality employees. Moving activities from a small to a larger impact within the municipal organisation, the implementation of the CB framework in municipal practice is furthermore understood as being able to form precedents for further implementation in other parts of the municipality as well as in other municipalities. The article explores the implementation of the CB framework in three principal steps.

First, above we have outlined possible meanings the carbon budget framework can result in when implemented in municipality practice. By meaning, we intend the interpretation of the CB framework by the municipality at both the personal and organisational level. The framework in itself does not stipulate a specific content in terms of measures to be taken; it merely provides a science-based methodology of apportioning the CO_2 emissions space using principles of equity. As such, the impact of implementing the framework will highly depend on what kind of content is co-created by the municipality. However, we argue that in order to take up the responsibilities detailed in the Paris agreement, the meaning of the CB framework needs to be characterised by ambitions of radical change, otherwise such high emissions reductions will not be realised.

Second, in relation to what an implementation of the CB framework and the meaning of the framework content (calculation and principles) in municipality practice could imply, coupled with an ambition of radical change, we draw on the change theory of Kotter. This provides an analytical lens to explore the CB framework with the purpose of identifying change conditions for its implementation. In line with our understanding of implementation as a process characterised by deep change we approach change, based on Kotter, as a deep transformative process. In the analysis, we have approached the implementation of the framework as representing a trans-

7. https://www.co2.earth/daily-co2

8. https://ourworldindata.org/grapher/cumulative-co-emissions?tab=chart

9. https://ourworldindata.org/grapher/share-of-cumulative-co2

formative and radical change of municipal practice in which the carbon budgeting may take precedence over the economic budgeting. As such, change in the article is understood as involving broad and inclusive participation and anchoring in municipal culture and practice.

Third, we delve into processes that can support the change conditions of implementing the CB framework in municipalities to support the achievement of the framework's change potential using the conceptual framework of scaling-as-learning (Mickelsson, Kronlid and Lotz-Sisitka 2018).

The authors' ambition is to contribute to the discussion around how the CB framework can be implemented, leading to radical emission reductions in municipalities, supported by the notion of sufficiency. This drive towards a monumental change away from current practice is explored using conditions of change to outline systematic processes to support and direct the co-creation of the CB framework meaning in municipal practice.

Theory

CHANGE CONDITIONS AT THE CORE OF IMPLEMENTATION

Incorporating the CB framework to steer municipal climate mitigation policy and action would imply a monumental and multi-faceted change process involving a large number of stakeholders both inside and outside the municipal organization, including politicians and municipal civil servants, as well as the business community and citizens. In this paper we focus our attention on the municipality as an *organization* and the change process that its political and administrative leadership and staff would have to engage in to implement the CB framework in municipal policy and practice. Inspiration is therefore drawn from the classic organizational change management model developed by J.P. Kotter (Kotter 1995). Kotter developed the model after having studied a large number of organizational change processes of different kinds, mostly in a business setting, where he concluded that most efforts fail either partially or completely. In this highly popular and often cited model, Kotter argues that for a transformation to be successful, it needs to go through a sequence of eight key phases, each identified to avoid common pitfalls. Here we use this model as an analytical lens to identify and discuss relevant aspects of how the CB framework could enable transformative change in a municipal setting. As such, Kotter is primarily used for a taxonomic purpose, to help structure and provide a vocabulary for how transformative change towards a more equitable reduction of CO2 emissions at municipal level could be realised. Further inspiration for choosing this analytical framework comes from the Swedish County Administrative Boards, that are using the Kotter model as guidance for working strategically with climate and other environmental goals at the regional level.[10]

The eight key phases of Kotter's model follow a progressive structure. Starting in building the foundations for change, the phases include *creating a sense of urgency* regarding the topic at hand that can motivate the *building and evolving of a guiding coalition*, which together *develops a vision and strategy for change*. This is followed by communication and concrete implementation, in which the *change vision is communicated* and *action on a broad-level is empowered, generating short-term wins*. Finally, the process is completed when the gains are *consolidated and used to produce more change*, in which *the change is anchored in culture* for long-term sustainability of said change.

SCALING-AS-LEARNING

In analysing processes that can support the change conditions outlined above we use a scaling-as-learning theoretical approach. The principal strength of the scaling conceptual framework is in its ability to bridge the shared learning processes of municipal employees and partners with a wider social learning framing to facilitate institutional transformation. The scaling conceptual framework draws on a broad international collaboration on learning in organisations, joining the more in-detail learning encounters of a Deweyan approach (Dewey 1938) with a post-Vygotskian social learning approach (Engeström 2016). Coupled with the development of this conceptual framework has been a practical reflective research process focusing on long-term change and transformation of institutional practices both in formal education and government. This reflective process builds on a project designed to address water management in Uppsala municipality, constituting a collaboration between the Swedish International Centre on Education for Sustainable Development (SWEDESD) and the Southern African Development Community Regional Environmental Education Programme (SADC-REEP).

'Scaling' is in the paper understood as moving activities from a smaller to a larger impact (Mickelsson, Kronlid and Lotz-Sisitka 2018; Elmore 1996; Looi and Teh 2015). At the centre of this theoretical approach is the emphasis on participation in implementation. This involves shared responsibilities and abilities to develop new knowledge of 'what is not yet there' in integrating, in this case, the CB framework in municipality practice. This conceptual framework identifies three dimensions of processes that support implementation. A *social* dimension, looking at collaborative participation and co-creation among municipality employees; a *temporal* dimension, looking at CB frameworks as long-term processes that need anchoring in ongoing practice as well as joint visions; and an *ethic* dimension, looking at participation of municipality employees as engaged in the co-creation of knowledge and adaptation of the CB framework.

In this article, we specifically draw on two processes that have an impact in many of these dimensions; *subjectification* and the formulation of *ends-in-view*. Subjectification can be described as the process in which municipal employees come to assume responsibilities and ways of acting in addressing global warming in their practice (Foucault 1982; Butler 1997). In said practice, this process involves mastery in terms of asserting an ability to act but also submission to expectations of how to act (Davies 2006). Agency, the ability to act in the specific practice, is thus conditioned on social expectations. As exemplified by Martin et.al. (2013), in medical practices dealing with complex challenges, subjectification processes can enable employees to recognise their agency in ongoing organisational practices,

10. "Miljömålsprocessen – ett förändringsarbete. Handbok för länsstyrelserna" (translation from Swedish: "The Environmental Goals Process – Change Management. Handbook for the County Administrative Boards"). https://www.lansstyrelsen.se/download/18.691fcf616219e10e93350e1/1526068075103/Milj%C3%B6m%C3%A5lsprocessen.pdf (in Swedish).

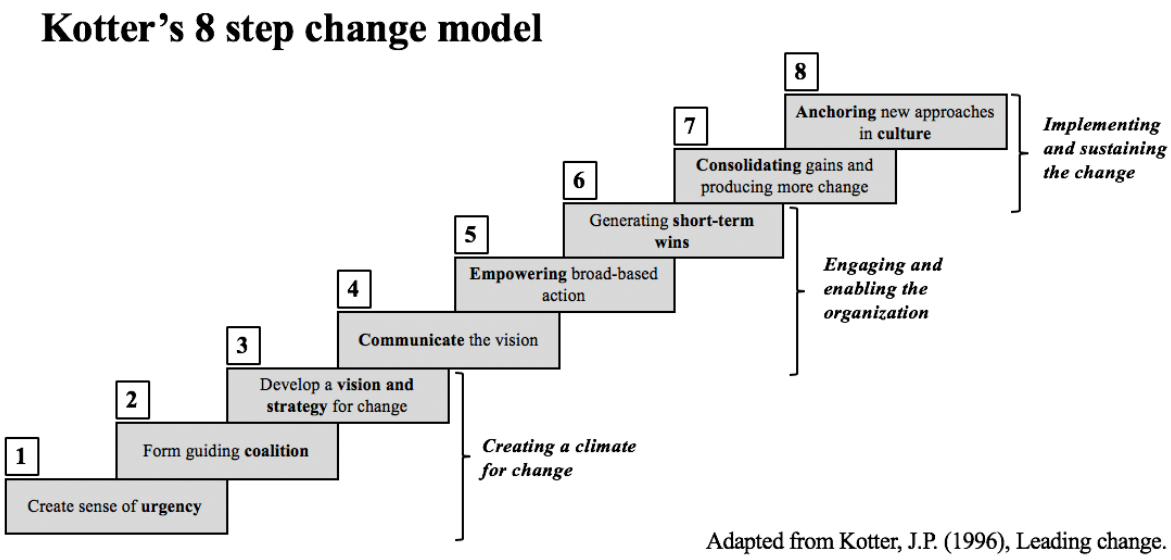

Figure 2. Kotter's 8 step change model.

resulting in the emergence of transformed relations between employees and the organisational practices. As such, subjectification can help in accounting for the emergence of joint learning as a potential driving force for organisational change. Andersson (2016) notes that in learning practices, subjectification and change are related as subjectification indicate moments in which our practices change and thus an opening for municipal employees can redirect joint municipal practices to adhere to the core content of a CB.

The formulation of ends-in-view can be described by differentiating it with purposes (Dewey, 1938; 1934). While the purpose is what a certain activity or practice is reaching for, or the goal to achieve, the ends-in-view can be understood as the sub-goals that those involved in an activity or practice are able to grasp and concretely visualise. As such, ends-in-view enable those involved in the activity or practice to relate to what they are engaged in to their experiences of previous or current practices, assisting in setting the direction of meaningful action towards the purpose (Dewey, 1938; 1934).

Analysis

ANALYTICAL APPROACH

The theories outlined above are operationalised in step two and three as outlined in the aim and outline of the paper. The change management model developed by Kotter (1995) is operationalised as a taxonomy for identifying change conditions in the implementation of the CB framework. As such, the theory is primarily an inspiration and grounding for step one of the analysis in order to structure what we view as crucial factors in the CB framework implementation and to highlight important themes.

The conceptual framework of scaling-as-learning is operationalised principally in the use of the analytical concepts of subjectification and formulation of ends-in-view. These concepts assist in step three of the analysis focusing on outlining processes which, as part of the implementation of the CB framework, can support the change conditions identified in step two.

It should be noted that at the conceptual level, the theories providing the analytical concepts for this paper offer an approach that have relevance for transformational organisational change. Applied to implementation of the CB framework, one should consider both the large-scale and long-term transformation such implementation would imply. The transformational change is thus understood as consisting of multiple, related change processes taking place in different parts, at different levels and at different times in the municipality organization.

CRUCIAL CHANGE CONDITIONS FOR IMPLEMENTATION OF THE CARBON BUDGET FRAMEWORK

Today, many municipalities already have ambitious climate goals and strategies that they are working towards, and while these are often genuinely challenging to achieve, they are not science-based (with a few exceptions, e.g. Manchester). A full implementation in accordance with a science-based municipal carbon budget, stipulating an average emission reduction rate of ~15 % p.a. arguably calls for a systemic change affecting all areas of municipal activity. Acknowledging the important challenge that municipalities do not have either the jurisdiction or the influence to control all emissions emanating from its territory, municipalities are nevertheless key public actors with responsibility for developing and implementing local climate policy in line with national and international climate agreements, including setting some conditions for climate action by other local stakeholders.

Based on our academic and empirical experience of working with energy and climate issues and carbon budgets in and with municipalities, combined with Kotter's change model, we identify and talk about change conditions for implementing the CB framework in municipalities. Given the complex challenge of aligning municipal activity with a territorial carbon budget, it is arguably important to take heed of the following conditions suggested by Kotter, in all types of change processes and at all municipal levels, that such a transformation would entail:

1. *Creating a sense of urgency* around climate change in the people who need to be involved in the change process and who will be affected by it. By explaining and connecting the global Paris agreement to the local level through an explicit and science-based emissions reduction trajectory for the territory of the municipality, the CB itself is a strong communication tool to support the notion that acting on climate change is in fact an urgent and globally shared responsibility. Compared to most climate targets that are set "at random", and that often lack links to the global carbon budget, e.g. "30 % CO_2 reduction by 2030", we believe that a science-based carbon budget calculated for the specific municipality provides strong and concrete evidence for the municipality leadership to take the issue seriously. Thus, the CB framework can help incentivise the municipal leadership to mandate far-reaching realignment of municipal policy, while also providing a strong argument for engaging the municipality staff and citizens in preparing for the transformative change process that will be necessary. Failure to install a sense of urgency of the need for the change throughout the organization will seriously hamper or could even derail the change process entirely.

2. *Building and evolving a guiding coalition* of municipal leaders with sufficient power, legitimacy and influence to lead the transformation called for by the CB framework. This group consisting both of political and administrative representatives with complementary competences needs to be fit for the task of leading a radical and long-term systemic change process. The group composition should be dynamic to be able to respond to the demands of the change process, something that is likely to evolve over time. Further, the work will require structured coordination and collaboration both within the municipality organization, and with external local stakeholders, but also with other municipalities and other levels (regional, national, and perhaps even international). For the guiding coalition to be successful in its task of managing the implementation of the radical change, a strong mandate and sustained support by the political leadership of the municipality is essential. Political disagreement between parties about the need for, or prioritisation of areas for major emissions reductions, could seriously undermine the process and its chances of success. In turn, the political leadership is dependent on acceptance for the change by the municipality's citizens, thus there is also a strong link with phases 3 and 4 below.

3. *Developing a vision and strategy* for the climate neutral municipality. The Carbon Budget sets out the scale and time aspects of the emissions reduction, however it does not explain *how* this is to be achieved in the respective municipality, i.e. what concrete measures need to be taken or how to prioritise between different policy areas. To get the necessary buy-in and avoid resistance against the transformative change process that is required, it is important to create a positive and rallying vision for what life will be like when the job is done. To be successful, the visioning needs to be highly inclusive and involve political leaders, municipal staff, local businesses, NGOs and citizens. The creation of a rich picture of a positive future provides the momentum into the change process, developing a sense of moving *to* something better and not only *away* from something unsustainable. The vision provides the guiding coalition with a foundation for building a comprehensive long-term strategy for the emissions reduction work. Putting that into practice could involve screening of all major municipality investments and decisions (e.g. investments, procurement, land leases to private businesses, etc.) to ensure their alignment with the CB framework, something that can also help identify "low hanging fruit" and win-win solutions. Development of clear targets and indicators coupled with rigorous follow-up is essential, as are incentives for good performance and strong disincentives for actions working against the change. Strong and sustained endorsement and support by the municipal political leadership is arguably critical for the vision and strategy to become credible and accepted.

4. *Communicating the vision* and strategy to anchor the change process in all involved stakeholders, both within the municipal organization and with citizens. To create buy-in and keep resistance at bay, the vision needs to come alive and make sense to people. For them to accept the radical emissions reductions that need to be realised, and to assume individual ownership to support the change process this entails, it is important that there is a basic understanding of the municipality's responsibility to contribute its fair share in reaching the global climate goals. As in phase 1 (create a sense of urgency), the CB framework constitutes in this way a powerful communication tool explaining and providing science-based evidence to support this understanding. To be effective, given the heterogeneity of the large group of people in a municipal setting that in one way or other exerts influence over and/or is impacted by the emission reduction change process, the vision and strategy must be communicated repeatedly and in different ways to different stakeholder groups. A focus on co-benefits for other areas than climate (e.g. health or children's wellbeing) of emission reduction initiatives can muster support also from groups that are less interested or knowledgeable about climate change. The acceptance from citizens is key for the sustainability of the change process and political leaders depend on it to stay in power. Without sufficient and quality communication throughout the change process, there is a high risk of failure.

5. *Empowering broad-based action* to implement the large-scale change in all affected areas. To effectively mobilise the necessary competences and allow room for the much-needed innovation that is required to implement the CB framework in municipal practice, it is essential to give autonomy and freedom of manoeuvre for stakeholders within and outside the municipal organization. The guiding coalition (phase 2) leading the change must also promote a culture of self-leadership and "transformation ownership" of municipality staff across the organization. Everyone needs to understand their role as change agents and the leadership must remove barriers to enable action, while at the same time identifying and tackling structures or thought patterns working against the vision and strategy. Capacity building and training of staff is an important change enabler, e.g. regarding climate-neutral public procurement. The change leadership can also have an important role in promoting

cross-sectoral and inter-organizational knowledge transfer partnerships and innovation collaboration projects aiming to reduce emissions in different areas.

6. *Generating short-term wins* in a long-term, systemic change process to keep the momentum and to energise and recognising the effort of the people involved. Celebrating partial success is also a way to keep the climate neutrality vision and strategy alive and relevant. Having concrete targets and rigorous follow-up is a prerequisite, providing evidence of progress. Communicating progress in the implementation of the CB framework widely is also key, e.g. keeping media up-to-date or publicly awarding outstanding achievement. Tackling "low-hanging fruit" could be one way of realising short-term wins, e.g. starting with eliminating "unnecessary" and uncontroversial practices that does not benefit anyone but has a considerable carbon footprint.
7. *Consolidating gains and producing more change* is important to avoid complacency and loss of momentum. The key is to build upon the short-term wins and scale the change, aiming for larger impact and spreading of carbon reduction solutions into new contexts, e.g. by making successful pilot projects permanent or starting new ambitious initiatives. The leadership is also wise to promote a "*Kaizen* culture" of constant learning and improvement to make the changes future-proof and sustainable over time, while also further developing and promoting the people involved as change agents.
8. *Anchoring new approaches in the culture* is essential for any change process to survive. The positive aspects of the change, i.e. benefits resulting from implementing emission reduction solutions in the municipality, must be communicated and accepted as superior to the old ways. Again, the communication must be customised to consider the heterogeneity of the stakeholders involved (phase 4). For the change to become the "new normal", attention must be paid to the cultural norms and values underpinning the change process. This process is greatly aided by including both internal and external stakeholders early on in the change process, e.g. in developing the vision (phase 3). It is also important that the leadership (guiding coalition) keep up the momentum, e.g. by taking in new people with other sets of qualities and competencies relevant to the new situation.

PROCESSES TO SUPPORT CHANGE CONDITIONS IN IMPLEMENTING THE CARBON BUDGET FRAMEWORK

In this section the analysis focuses on processes supporting the change conditions in implementing the CB framework in municipalities. As stated above, implementation is understood as how the CB framework can be integrated as a guiding part of municipal practice. Implementation is understood as changing concrete actions by stakeholders (politicians, directors and experts), ranging from policy to practice in the municipality regarding what is to be done in the sense of realising change that achieves the stipulated CO_2 emission reductions. Building on the previous analytical step we detail, with the support of the conceptual framework of scaling-as-learning (Mickelsson, Kronlid and Lotz-Sisitka 2018), two processes that supports change conditions for implementation.

Supporting change conditions for implementation through subjectification

Applied to the implementation of the CB framework, subjectification means that those involved in municipal practice are expected to act in certain ways, i.e. assume subject positions. In the case of the carbon budget, the supportive power of subjectification can be exemplified in municipality employees and policy makers, assuming subject positions of actively engaging in implementing the CB framework. Such subjectification would support their empowerment in contributing to the direction of change brought about in municipality practice through the implementation. Creating these expectations on municipality employees and policymakers can furthermore generate collaborations and contributions across the municipality organisation and with community members, thereby enhancing the sensitivity and relevance of the implementation to other parts of the municipality organisation and beyond. Processes of subjectification can thus, by having expectations directed towards municipal policy makers and practitioners, support the creation of a sense of urgency in addressing global warming. Meanwhile, to productively support the further implementation of the CB framework, subjectification would need to go beyond just the generation of a sense of urgency and empower municipal employees to take action through the offering of approaches that are ethically acceptable to them.

Supporting change conditions through end(s)-in-view and implementation language

Short-term wins have previously in this text been outlined as a crucial change condition for the implementation of the CB framework as it creates motivation, direction and a basis for continuous engagement among policy makers and municipal employees for what may seem like an overwhelming challenge. To support the generation of such short-term wins a process of formulating sub-goals can be used to make the challenge of global warming more manageable. In order to conceptualise such sub-goals to support the change conditions of implementing the CB framework we use the lens of end(s)-in-view (Dewey 1938). End(s)-in-view is understood as the immediate goals we have in front of us and for which we can imagine a number of concrete steps to reach. It is here differentiated with purpose(s) that are what we want to achieve long-term but that are harder to specify concrete steps to attain. While the long-term purpose of the implementation is radical change of municipal practice, *end(s)-in-view* support the change condition of short-term wins by enabling those involved in the implementation to identify sub-goals that they can "perceive". I.e. they draw on their expertise and experiences of municipal practice to adapt and operationalise the CB framework in some part or parts of the municipality (Maivorsdotter and Wickman 2011; Dewey, 1938; 1934). The learning process, in this case performed by municipal employees, of re-formulating an overarching purpose to concrete and perceivable ends-in-view, involves setting the purpose of addressing global warming in closer relation to the actual municipal practice. Elkjaer (2004; 2005) illustrates how such organisational learning, based on a Deweyan perspective, can assist municipal employees in relating larger societal challenges to both their own practices and that of the organization, or in this case the municipality, resulting in enhanced organizational learning.

A crucial part in this process of formulating of end(s)-in-view is having access to a language with which the municipal employees can talk about the practice. Such a language enables the articulation and communication of why and how short-term wins and gains were achieved and helps in taking the implementation of the CB framework further. With respect to consolidating gains, this involves deepening action and efforts rather than just trying to spread it onwards. To have this supporting function over time the implementation needs to engage with the environment of those involved in the implementation of the CB framework. In order for the implementation to over time become less dependent on external support we argue that it is necessary that municipal employees assume responsibility for the continued work with, and according to, the municipal CB (Coburn 2003; Clarke and Dede 2009). Such a shift would support change characterised by broad-based action in which those involved in the implementation has the autonomy to develop new solutions and drive the change. Following McLaughlin and Mitra (2001), this would support the CB framework becoming an internal part of the ongoing practice of the municipality.

Discussion

The aim of this paper was to enquire into the conditions for implementing the carbon budget framework in municipal practice. To fulfil this aim we have studied the implementation of the CB framework from a perspective of change and how processes can be used to support the conditions enabling such change.

The results of our study illustrate how the implementation of the CB framework in municipal practice largely depends on the meaning co-created by the municipality regarding the framework, i.e. the degree to which the framework is to direct municipal practice or remain as an add-on to business as usual. As the framework offers content in terms of a method for apportioning CO_2 emissions space in a science-based manner, as well as principles of equity, the local meaning of the framework can be co-created by municipalities in a number of ways with respectively varied ambition levels in terms of contributing to achieving the goals set out by the Paris agreement. While the development of what can be read by researchers and practitioners as a far-reaching framework for addressing carbon emissions may seem unambiguous and somewhat straightforward to implement we show that this is not obvious. In the first step of the study the potential range of meaning that the framework may take through co-creation by the municipality is highlighted. As such, the framework can take multiple meanings.

We argue that it is imperative to appreciate the full extent of what the CB framework can be understood to mean for municipal action on global warming, in line with principles of equity and sufficiency. As such, in the analysis we have approached the implementation of the CB framework as a transformative and radical change in which the carbon budgeting may take precedence over the economic budgeting. If we are committed to this, then it is crucial to develop support structures within the municipality to create the change conditions that could facilitate such change. Developing a deeper understanding of the eight phases of change as outlined by Kotter, and processes that can support them would help in directing the meaning of implementing of the CB framework as a radical and transformative change. Furthermore, the progressive structure of the change conditions could assist in municipal decisions on the timing of specific efforts to support change aimed at realising radical emission reductions.

From this follows that if the municipal co-created meaning is to be the high ambition and radical transformative change that we argue is a consequence of the Paris agreement then the implementation of the CB framework needs to be approached and supported in a systematic way. This paper has been an initial step in contributing to such a systematisation of implementing the CB framework in practice.

While municipalities can be committed to a CB, the practical integration of such radical and transformative changes into practice may not be possible to immediately realise to its full extent. In reality this could mean that a municipality, as a first step, officially recognises the importance of the framework and start including references to it in policy documents, e.g. as in the case of the Swedish municipality of Järfälla where the carbon budget is mentioned in its 2017 annual report. Such initial steps, while not sufficient in the face of climate change, could nevertheless be understood as necessary initial steps towards integrating the CB framework in municipal practice. The case of Manchester in the UK goes a step further than this, demonstrating a high commitment to adhering to the CB framework by approving a policy for a for a year-to-year emissions reduction of 13 % p.a. commencing in 2018. Manchester's draft plan to become a "Zero Carbon City by 2038" is indeed based on the carbon budget calculated for the city for the period 2018–2100.[11]

Through the analysis the paper offers a way for municipalities and those involved in implementing the CB framework to self-reflect on what kind and degree of change they are trying to achieve, what change conditions are necessary to enable this change and how they can use the processes of subjectification and the formulation of ends-in-view to support these conditions. Thus, the results of the article consider the diversity in current municipal practice and what forms of change may be necessary in order to ensure a long-term commitment to fulfilling the carbon emission reductions mandated by the CB framework for the territory of respective municipality, ultimately making an equitable contribution to the goals of the Paris agreement.

Further research

This paper has outlined a systematic and theory-based approach for the implementation of the CB framework in municipal practice. We believe that the change theory of Kotter (1995) as well as the supporting processes outlined above, chosen as analytical tools here can indeed by useful for decision makers at local level to better understand and plan for the change implicated by the CB framework. At the same time, analysing the municipal change processes through other theoretical frameworks would constitute valuable contributions to this field.

Furthermore, the notion of sufficiency in relation to the CB framework needs to be further explored. Moving from thinking of emissions year-by-year to thinking about them in a cumu-

11. http://www.manchesterclimate.com/content/framework-2020-2038

lative way, as implicated by the CB framework, will pave the way for the need to describe sufficiency in more detail. On the other hand, if politics is moving into a sufficiency paradigm, CB will be easier to implement. Thus, the synergies between these terms also need to be explored further.

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