



Implementation of local climate action plans: Copenhagen – Towards a carbon-neutral capital



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ARTICLE INFO

Article history:

Received 16 April 2017

Received in revised form

26 July 2017

Accepted 18 August 2017

Available online 30 August 2017

Handling Editor: Yutao Wang

Keywords:

Implementation

Assessment

Indicators

Monitoring

Energy transition

Mitigation

ABSTRACT

The purpose of this article is to improve understanding of local climate action plans and their implementation and evaluation. It explores how goal definition and the choice of assessment metrics frame goal attainment and influence implementation behaviour. Using the Danish capital of Copenhagen for an in-depth case study, we map activities undertaken and assess implementation performance in terms of infrastructure changes and GHG emission reductions during the period from adoption of the first climate action plan in 2002 to the present day (2017). The study shows that while Copenhagen exhibits a high overall implementation performance, both in terms of changes in energy supply and emission reductions, these metrics are only partially linked. It also shows that inconsistencies between the system scope of the base year emissions and goal attainment, due to the use of offsetting, may lead to system developments that inhibit further changes beyond the initial target period. The article concludes with a list of lessons learned for other cities that are in earlier stages of climate planning. Most importantly, the study points to the need for activity-related evaluation metrics, scope consistency, and targets that can provide a robust incentive through changing energy systems.

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1. Introduction

Mitigating global climate change will be one of the defining challenges facing current generations (Scrase et al., 2009). While the problem is global in nature, the human activities driving climate change are indisputably local. The greenhouse gases (GHG) accumulating in the atmosphere are the result of emissions from the use of fossil fuels and from agriculture, forestry, industry and waste taking place in a local context (Wilbanks and Kates, 1999; Bai, 2007; Bulkeley, 2013). In mitigating the problem, we should focus our attention on reducing these emissions, and in doing so local governments may play a crucial role (Rayner, 2010; Fudge and Peters, 2009; Musco, 2010). In this paper, we aim to expand the knowledge of climate change mitigation activities by local

governments by studying the implementation and assessment of local action after the adoption of a local climate action plan (CAP).

Reviewing the field of local climate action, we can observe that a large number of local governments are joining international networks, adopting local CAPs and pledging ambitious mitigation action (Bulkeley, 2010; Corfee-Morlot et al., 2009; Damsø et al., 2016a; b). This emergence of local climate action planning and the adoption of local CAPs have been studied extensively. To name a few such studies, Wheeler (2008) assessed the first generation of CAPs adopted by US states and local governments, Bedsworth and Hanak (2013) surveyed the adoption of policy tools and programs in California, Dixon and Wilson (2013) examined the attitudes of climate change officers in UK cities, and Damsø et al., (2016a; b) studied the extent of local climate action planning in Denmark. Far less research, however, has been conducted on what happens after the adoption of a CAP, i.e. on its implementation and subsequent evaluation, with several authors highlighting the lack of impact studies as an urgent issue to be addressed (Bulkeley, 2010, 248; Salon et al., 2014; Wheeler, 2008). Turning first to *implementation*, the studies that have been completed point to significant difficulties with the execution of these action plans, indicating that they are seldom implemented fully and are characterised by grabbing the ‘low-hanging fruit’ while not addressing the more

Abbreviations: AMW, Amager CHP; AVV, Avedøre CHP; CAP, Climate Action Plan; CHP, Combined Heat & Power; CCS, Carbon Capture and Storage; CPH, Copenhagen; DH, District Heating; EV, Electric Vehicle; GHG, Greenhouse Gas; GPC, Global Protocol for Community Scale Greenhouse Gas Emission Inventories; HOFOR, Hovedstadens Forsyning [the capital's utility company]; LG, Local Government; PV, Solar Photovoltaic; W-t-E, Waste-to-Energy plant.

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challenging long-range aspects (Musco, 2010; Bulkeley, 2013; Rice, 2013; Sperling et al., 2011; Milliard-Ball, 2012). Implementation is usually evaluated through performance assessments, which determine whether the effects of plan implementation are indeed the desired effects (Crossley and Sørensen, 1983). The indicators that are used while monitoring performance influence the perception of goal attainment.

This article intends to fill the knowledge gap on CAP implementation through an extensive case study of Copenhagen, the capital city of Denmark, and to discuss the inter-relationship between implementation and performance assessments. The aim is to improve the validity and utility of monitoring systems in ensuring the contribution of local CAPs to climate change mitigation. Copenhagen was chosen for several reasons: it was one of the first cities to set ambitious climate change mitigation targets; it is a large capital city and a member of the C40 group; and it is renowned as a leading environmentally friendly and green city (EU, 2013; Floater et al., 2014; Morlet and Keirstead, 2013). The city has a goal to be climate neutral by 2025 (we will discuss later what that implies). The fact that the city has been actively involved in climate action planning for nearly two decades makes it possible to study the relation between the planning and implementation stages, and further to study how CAPs are developed over time, and from this to flesh out important lessons for other cities that are at earlier stages of climate action planning.

2. Methodology

A **case study approach** is applied in studying implementation and assessment, to allow an in-depth review (EC, 2004; Bryman, 2004). The Copenhagen municipality has been selected as the case. The key methodological approach is **document analysis**, utilizing both quantitative and qualitative content analysis techniques (Robson, 2011). The documents used in the analysis were collected from websites, supplemented by online search engines and email enquiries.

The document analysis included the following documents:

- Greenhouse gas accounts 2005 and 2008–2015
- Environmental accounts 2007–2014
- CPH Climate Project reports 2014 and 2015
- Midterm evaluations 2012–2015
- Municipal budgets for 2004–2016 and annual financial reports from the local utility company, HOFOR, and subsidiary companies for the same period
- Municipal Climate Action Plans 2002, 2007, 2009 and 2015
- Municipal spatial plans 2005, 2009, 2011 and 2015
- Municipal waste plans for 2008, 2012 and 2018 (target year)
- Waste water plans for 2008
- Strategies from local utility companies Biofos and Københavns Energi (Copenhagen Energy, now HOFOR).
- In addition, a screening of all reporting to LG networks in which Copenhagen participates, and information on specific initiatives at all relevant websites have been conducted, and results added.

The collected data were sorted and key information extracted with content analysis techniques, through which the targets and initiatives of the various CAPs were identified and sorted following a specified coding manual. Implementation was then assessed by reviewing the aforementioned documents thematically, following a categorization established by the CAP content. Subsequently we conducted an analysis of implementation, performance and assessment tools using the method and approach described in the next section.

In addition, **interviews** were subsequently conducted with key

actors, with the aim of qualifying our observations on implementation performance and providing additional information on the implementation process and methods of monitoring performance. Two interview techniques were employed: 1) a semi-structured technique in which an interview was conducted, condensed, and a transcript submitted to the interviewees for verification, and; 2) a structured interview in which a list of questions was submitted to the interviewee and answers were returned by email (Bryman, 2004; Connolly et al., 2010). The choice of technique for each interview was based on interviewee availability, with the former being the preferred method and the latter applied in cases of unavailability.

2.1. Local planning efforts

In categorising and using the extensive data, we distinguish between the stages of planning, implementation and assessment following Crossley and Sørensen (1983). We study the implementation work of Copenhagen municipality and its continuing performance assessments, in order to assess the long-term relevance of implementation activities and the utility of assessment measures in informing local planning efforts.

2.1.1. Planning

Several aspects of CAP content are of key relevance for implementation and performance assessment, in particular the scope, the target, and the strategies and activities to be undertaken in reaching it. The *scope* defines the boundaries of the emission system, which includes defining and delimiting the spatial boundaries, sectors, and activities included (Kramers et al., 2013; Levin et al., 2014). The *target* determines the temporal scope, the unit, range and type of objective at hand (Kramers et al., 2013; Levin et al., 2014; Damsø et al., 2016a; b). Finally, *mitigation strategies*, or activities and initiatives, are formulated to be undertaken in reaching the target (Boswell et al., 2012).

2.1.2. Implementation

Implementation is the stepwise process of executing a plan and translating goals into action (Ryan, 2015). Each individual project must both stand alone in the present-day system, and contribute towards the overall strategic target of the CAP. In this study we use a logical framework approach (EC, 2004) in distinguishing between the plan's implementation and its effect (measured as changes in GHG emissions).

2.1.3. Assessment

Most approaches in local climate action planning employ a traditional goal-attainment evaluation model, in which assessments are primarily used to determine goal attainment (Hansen, 2011). Furthermore, assessments have the operational purpose of contributing to the design and modification of interventions, as well as the accountability aspect of reporting on achievements (EC, 2004; Crossley and Sørensen, 1983). Following this approach, assessments can be conducted for output, outcome and impact respectively, usually by the formulation of indicators, i.e. metrics providing information on performance (Boswell et al., 2012; Hammond et al., 1995; Rich et al., 2014). To simplify the analysis we distinguish between planning, implementation (actions) and effects (changes in GHG emissions). The relationship between the key concepts of the different planning stages is illustrated in Fig. 1.

3. Results

Copenhagen is the capital of Denmark. The city is situated on the eastern coast of Zealand, along the Øresund strait. It is joined to

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