Evaluation of the German National Climate Initiative – Impacts and success factors and insights into the continued evaluation of the funding program

Dr. Katja Schumacher, Carina Zell-Ziegler, Öko-Institut, Berlin
Dr. Kerstin Tews, Dr. Maria Rosaria di Nucci, Freie Universität Berlin
With contributions from
Tanja Kenkmann, Julia Repenning, Öko-Institut, Freiburg/Berlin
Angelika Paar, Lothar Eisenmann, Lisa Muckenfuß, ifeu, Heidelberg
Dr. Hans-Joachim Ziesing, Berlin

ABSTRACT

The German National Climate Initiative (NCI) is a cornerstone of the German Government's ambitious plans to reduce GHG emissions. It was initiated in 2008 to contribute to the German climate targets. The NCI aims to change behavior and stimulate investment towards lower GHG emissions by bringing together different actors, taking local initiative, reducing barriers and setting examples for multiplication and imitation.

The NCI funds diverse projects and programs including campaigns, broad and specific information programs, local energy/climate concepts as well as stimulus programs for efficient lighting, renewables or household-scale cogeneration facilities. Each program/project tackles at least one target group: consumers, municipalities, business and/or education. Since its start, the NCI has funded more than 25,000 projects with close to 800 million Euros.

The NCI is the first German mitigation program which has been subject to policy evaluation from the outset on. A systematic theory-based methodology was developed to take the challenges due to the broad range of intervention types adequately into consideration. Clustering interventions according to program logic and mapping out their causal chains proved very useful to attribute levels of impact to types of intervention.

This paper describes the activities under the NCI, presents the evaluation approach and provides findings of the evaluation (on investments, GHG reduction, employment effects etc.). We found substantial differences between information-based and investment-based policy instruments, and between the various information-based project approaches. Moreover, the paper describes success factors and lessons learned that could also be helpful in other contexts.

Acknowledgments

The authors wish to thank all team members of the NCI evaluation projects for their valuable contributions and comments to the project and this paper. The paper is based on two evaluation projects (Evaluierung der Nationalen Klimaschutzinitiative, FKZ 03KE0002 und 03KSE009) which have been funded by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) within its

National Climate Initiative (https://www.klimaschutz.de/en/node/35542/). The views expressed by the authors do not reflect the views of the BMU or any other institution.

Introduction

The German energy transition strategy consists of many different actions and programs aimed at exploiting the existing greenhouse gas (GHG) mitigation potentials and at mobilizing the necessary resources to reach ambitious mitigation targets. This strategy builds upon the German government's Integrated Energy and Climate Program (BMU 2007) as well as its Energy Concept (BMU and BMWi 2010) and is described in detail in various official documents (BMU and BMWi 2011). The National Climate Initiative (NCI) of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) represents an important element of the programs and measures relating to the energy transition. It aims to provide substantial support for the reduction of Germany's GHG emissions by 55 % by 2030 and by 80-95 % by 2050 compared to 1990 levels. The NCI is geared to bring about more climate-friendly behavior among businesses, consumers and municipalities in areas with important mitigation potentials that cannot be tapped using instruments like the EU Emissions Trading Scheme. The NCI is financed from revenues accruing from auctioning revenues of the EU emission trading system (EU ETS), and is supplemented by funding from the German Energy and Climate Fund.

It funds very diverse projects and programs, ranging from activities raising energy-awareness and climate-friendly behavior, the use of efficient technologies and renewable energy, to measures relating to all aspects of mobility.

The NCI projects and programs include campaigns, broad as well as specific information activities, pilot projects, integrated local energy and climate concepts as well as investment grants for efficient lighting especially for street lighting in cities, individual projects such as the CO2-neutral modernization of an entire school, renewable energies, efficient cooling equipment or micro-cogeneration facilities in the residential building sector. The instruments used within the NCI can be broadly split into investment-based and information-based incentives.

The need for consistent monitoring of activities under the energy transition has been recognized early on and regular monitoring reports are a fixed asset of the assessment process (e.g. BMWi 2014). With respect to the NCI, an evaluation was initiated from the outset on. The NCI evaluation has taken place in two phases so far. The first evaluation phase covered the years 2008-2011 and assessed the NCI based on a set of 12 mixed impact indicators, like GHG emissions mitigation, mitigation costs, employment effects, induced investment, outreach, innovation and replication (NCI Evaluation Consortium 2012; Schumacher et al. 2013; Schumacher et al. 2014). The second evaluation phase is still ongoing and covers the years 2012-2017; a first report covering the years 2012-2014 has already been published (NCI Evaluation Consortium 2017). In the second phase, the evaluation criteria were slightly revised and indicators fine-tuned to better reflect outcomes and impacts.

This article describes the activities within the NCI during the evaluation period with a focus on the years 2008-2014, presents the evaluation approach, and illustrates some of the findings of the evaluation as well as lessons learned for following projects/programs aiming at contributing to reach the ambitious mitigation targets.

Methodology

General approach

In order to comprehend the wealth of NCI projects and their objectives, but also to be specific enough to measure the contribution of the diverse individual projects, an integrative methodology was chosen that borrows elements of formative and summative evaluation theory as well as bottom-up data

collection, monitoring, and calculation methods in order to properly cover the projects and their challenges.

The aim of the evaluation was to measure the impact of the National Climate Initiative (NCI) and of the projects supported within this framework according to a given set of criteria. In 2008, the Ministry of Environment had selected a set of four core criteria (innovation, greenhouse gas emissions reduction (GHG), multiplier effect, economic effects) which served for the choice of projects to be recommended for funding. However, for the purpose of the overall evaluation, these criteria needed further refinement and operationalization by defining measurable indicators for each criterion.

The major methodological challenge was the wide variation of projects and initiatives of the NCI with regard to i) the addressed carbon saving potentials, ii) the target groups and iii) the type of intervention to induce a change in behavior or in investment decisions. Projects and initiatives were therefore clustered according to intervention type and the underlying causal chain of effects. For each of the clusters we defined comparable indicators at the level of input, output, outcomes and impacts (see section cluster approach).

Figure 1 depicts the general evaluation framework. The evaluation was based on a bottom-up logic starting with activities at the level of projects and initiatives to gather findings on an aggregated level for the entire NCI. The general approach for the evaluation of the individual projects was based on assessing the aimed goals with the actual performance for all criteria. Based on a bottom-up logic, we calculated or estimated outcomes and impacts. In the case of the achieved emission reduction, the additionality of the GHG-savings was measured against a defined reference development or a "business as usual scenario". The underlying assumption was that measures triggered within the NCI framework would not be implemented within the "business as usual" scenario.

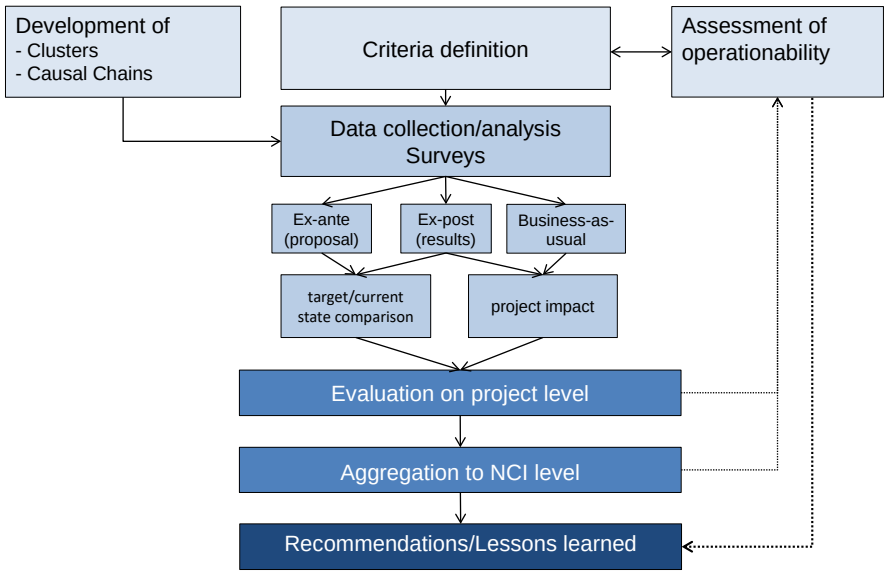

Figure 1: Methodological framework

Data and information was gathered from project documentation or program data collected by the entities commissioned by BMU to administrate the projects or programs, mid-term deliverables and final reports compiled by the projects as well as internal monitoring activities. Additionally, the evaluators used a variety of available empirical data or conducted interviews and online surveys to gather the necessary information and data.

Cluster approach and bottom-up calculation of GHG mitigation for information-based interventions

The NCI projects and initiatives were clustered into two broader groups: investment-based interventions and information-based interventions, mainly because they pose distinct challenges on filling the gaps for the bottom-up calculation of GHG-mitigation.

We developed a simplified bottom-up model for calculating/estimating the GHG-mitigation to depict at which points data is needed to fill the gaps (see Figure 2). The model is based on the recommended European Norm for "Energy efficiency and savings calculation –Top-down and Bottom-up methods" (CEN 2012).

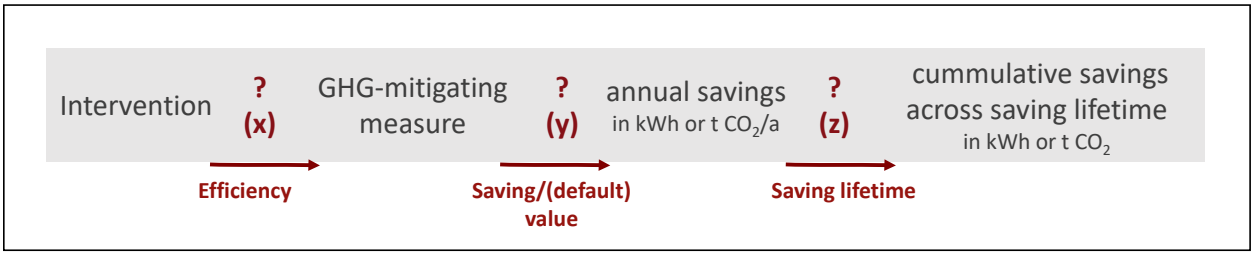

Figure 2: Our simplified model for gap identification in the bottom-up chain of saving calculations

This model is particularly useful for evaluators of information-based interventions affecting the patterns of usage or to stimulate investments in their specific target group of end energy users. Such types of interventions are regularly faced with the fact that the information communicated must be transformed into action or a specific set of saving measures within the target group. As a result, there is no clear indicator available to determine the efficiency factor of such information-based interventions (see gap "x" in Figure 2). This is in contrast to investment-based interventions where investment in efficient technology is directly supported by grants or subsidies and the causal chain from intervention (financial support) to GHG-mitigating measure (implementation of technology) is given by default, the efficiency factor is thus 1.

We further introduced a portfolio of sub-categories of information-based interventions, based on empirical findings from environmental psychology and behavioral economics. The literature distinguishes between i) the kind of behavior addressed (user routines vs. investment decisions) and ii) the degree of individualization of the information offered. These distinctions are relevant as they influence the effectiveness and efficiency of informational interventions (Tews 2009). Regarding i), the addressed behavior is relevant in terms of saving potentials (*effectiveness*). Saving potentials that can be tapped by investments in more efficient appliances and devices are much higher than saving potentials tapped by changing user routines (e.g. Bürger 2009: 80). Furthermore, user routines are much more difficult to change than one-shot deliberate investment decisions. Regarding ii), the degree of individualization of an information-based intervention is relevant for the *efficiency*. Empirical results confirm that broad and mass information campaigns are less efficient in terms of their effect on behavior or decisions than individualized information or on-site counselling (e.g. Abrahamse et al. 2005).

On the basis of these considerations, four clusters of information-based interventions were defined:

i. *"Mass or broad campaigns"* provide a fundamental orientation, simple recommendations and raise problem awareness. Campaigns reach a large number of people, but are assumed to have a low efficiency rate. Accordingly, the efficiency factor of mass campaigns amounts to about 1-2 % - indicating that 1-2 % of those who are reached by the campaign actually take action and change behavior or invest in more efficient technology - which has been qualified as a relatively high approximation (MultEE 2016:6).

ii. "*Knowledge transfer to change investment decisions*" offers practical, situation or product-specific but not individualized information to those who seek to steer their investment by knowledge on savings, e.g. a website comparing the energy efficiency of products.

iii. "*Specific advice services*" provide individualized and situation-specific advice. It is characterized by its direct contact/interaction between advisor and advisee. This type of intervention is assumed to be most efficient in changing decisions and behavior of the target group, but has very high costs per contact. Studies report an efficiency factor of 20 % per advice services in households, i.e. about 20% of the households change behavior or decisions in response to the advice serve (MultEE 2016:13).

iv. "*Networking/best practice transfer*" reflect and utilize dynamics between peers to adopt innovations due to mutual trust in competence, similar challenges but also in response to competition. The mechanisms underlying their efficiency and effectiveness have been described in diffusion research (Tews 2005). Networks and best practice transfer have become increasingly relevant within the NCI.

For all information-based clusters, the data necessary to fill the gap "x" to determine the efficiency factor of an intervention is difficult to gather. Default values according to intervention type do not exist, efficiency of interventions differs even within a cluster. Moreover, the addressed behavior influences the efficiency of an intervention. Consequently, evaluators have to decide whether to collect data via cost-intensive ex-post surveys within the target group or to rely on empirical findings of previous evaluations - when available - or on expert estimates.

In addition to the efficiency of an intervention (gap "x" in Figure 2), there are still two more gaps to fill: the saving values ("y") and the saving lifetime ("z"). Particularly the saving values create difficulties for a calculation or estimation. Regarding the type of addressed GHG-mitigating measure (the addressed behavior) we distinguish between investment decisions, changes in usage patterns and changes in organizational routines. The need to quantify savings of such induced changes is easier to manage for induced investments in more efficient technical devices than for induced behavioral or organizational changes. There is an understandable lack of harmonized default values to estimate the saving values but also the lifetime of savings. Even in cases where reference values exist for a given behavior or bundles of behavior, these suffer from a rather low reliability – partly due to their intransparency, but mainly due to the fact that the induced savings depend on variable context and project specific factors. Therefore the room for a generalization is rather small.

In sum, bottom-up calculations of information-based interventions cannot rely on default values for any of the gaps described above. To solve these problems, evaluators are confronted with the necessity to manage the trade-off between gathering project-specific – and as such more reliable – data by conducting time- and cost-intensive monitoring measures or to rely on available reference values, which frequently suffer from a rather low reliability. We assume, that the introduction of a "reliability coefficient", as proposed by the EMEEES-Project (Vreuls et al. 2009:13), can be a way to differentiate data quality and reliability of the calculated savings. Regarding our evaluation results of the information-based interventions, we just started to use this differentiation and introduce discounts to the estimated savings according to their reliability.

However, despite of these empirical shortcomings, the approach of establishing causal chains based on the bottom-up method does have an important side effect on the quality of the funded projects. Due to our communication and feedback in NCI projects networking meetings and the fact, that our simplified model (see Figure 2) has been added recently to the NCI call for proposals of the Ministry of Environment, projects applicants are more prone to think in terms of causal chains and are somehow stimulated to adapt their project and management in order to improve the design of their interventions and their own monitoring of activities.

Evaluation Criteria

The criteria for the evaluation were derived from the stated objectives in the NCI. In designing the criteria and respective indicators we considered the recommendation of the European Commission (2005) that objectives and indicators used should meet the SMART and the RACER characteristics: they should be specific, measurable, achievable, reliable and time-bound; and they should be relevant (closely linked to the objectives to be reached), accepted, credible, easy to monitor (data collection should be possible at low cost), and robust against manipulations.

In order to evaluate the impact of measures which would properly take into account the goals of the NCI initiative, it was felt paramount to identify appropriate criteria fulfilling the SMART and RACER requirements. In many cases, however, it was difficult to isolate single parameters, qualify their impact and anticipate the robustness of the indicators to be chosen. As a further analytical tool, a matrix was developed to identify and classify the appropriateness of each criterion and of the respective indicators for each of the defined clusters.

The four main criteria chosen for the first evaluation phase were: (i) GHG emission reduction, (ii) model character, (iii) broad impact and (iv) economic effects; and major questions were formulated for each category. Second, these questions were translated into a framework for the evaluation consisting of sub-criteria and indicators. Only part of these criteria could be measured in an objective, quantitative way. In the second evaluation phase encompassing NCI activities commencing in 2012, the evaluators performed a critical examination of the appropriateness of all criteria. This step was necessary because the experience of the first evaluation phase had pointed out that not all of them could be evaluated through possibly smart indicators and that – because of the diversity of the projects – the comparability of the indicators was not always given. Moreover, it became necessary to check and adjust these criteria to make them relevant for the high number of new projects supported since 2011 within the so-called "Kommunalrichtlinie" (directives for municipalities and administrations supporting local actions to reduce GHG). Thus, the criteria were marginally revised and complemented by sub-criteria. The so-called "model character", a sub-criterion in the first evaluation period, was upgraded as criterion and included i.a. the feasibility, transferability and visibility of the measures. A new criterion "continuity" was introduced to encompass the sustainability of the projects beyond the time of the NCI support.

Because of the objectives of the NCI, the core criterion to assess it relates to climate protection. As explained in the previous section, the calculation of the GHG effects and the availability of data depended enormously on the intervention type and cluster. To account for the missing direct causal link between the facilitating measure (e.g. awareness campaign) and the induced end-use energy efficiency improvement measures, we differentiate between realized savings in relation to investment activities, induced savings in relation to information-based interventions and conceptualized savings (savings potentials which are calculated within climate concepts but have not been implemented yet).

The evaluation of the defined 'soft' criteria is based on a combination of qualitative and partly quantitative assessment. The economic effects are based on quantitative assessments, indirect employment effects are assessed by utilizing an input-model for the German economy.

Analysis and results

The methodology described above was applied to all individual projects and programs of the NCI that were funded between 2008 and the end of 2014. An ongoing evaluation additionally covers the years 2015-2017. However, results for this period are not yet available. The presentation below shows aggregated findings on the NCI level as a whole and additionally by type of intervention or cluster as well as target group. The evaluators were able to attest clear positive effects of the National Climate Initiative for the period 2008 to 2014.

NCI funding and financial multiplier effect by cluster

Between 2008 and 2014, approximately € 450 million of governmental funding was spent.[1] About 60 % of the funding was spent on financial support programs (investment-based interventions) like the support scheme for commercial cooling systems, the support program for municipalities to install more efficient street and indoor lighting systems and the stimulus program for micro combined heat and power (CHP) plants in private households and small businesses. 13 % of the total funding (€ 58 million) was spent on municipal climate concept development. Projects funded through information-based interventions like specific advice programs, mass campaigns, provision of knowledge to change investment decisions, education as well as networks and best practice transfer made up 23 % of the total funding amount, see Figure 3.

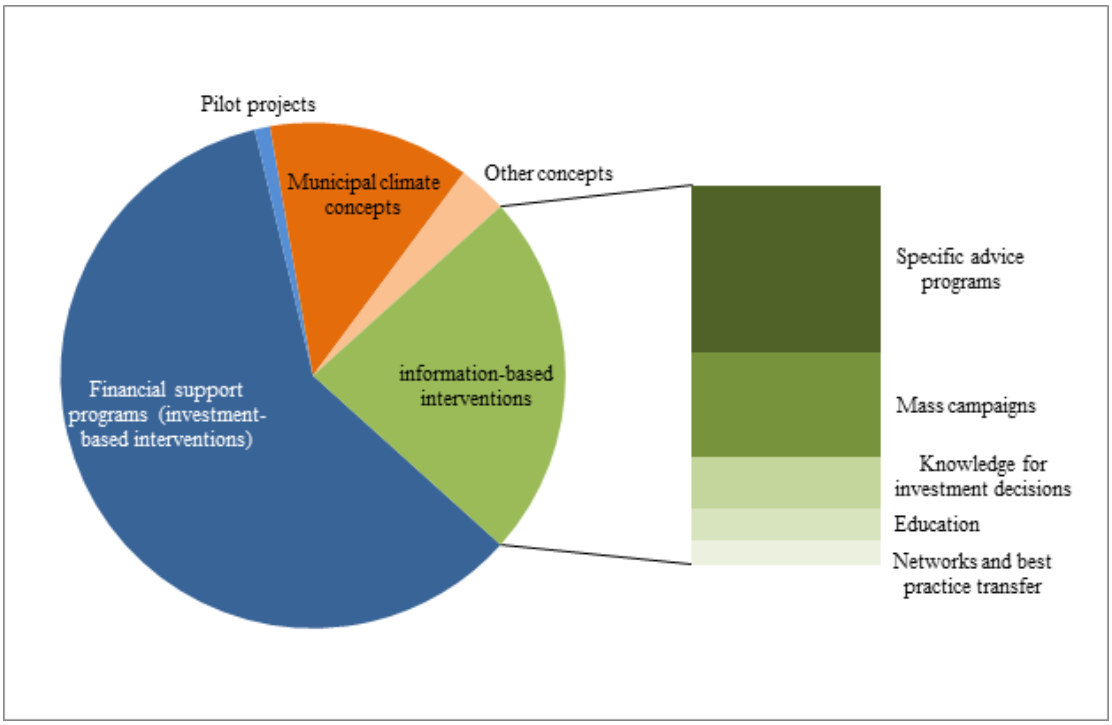

Figure 3: Distribution of funding by cluster

The evaluation showed that the economic leverage effects of the NCI were high: In total, approximately € 1.2 billion of total gross investments were triggered by the NCI. 95 % of these investments were triggered by financial support programs like the stimulus program for micro-CHP plants and commercial cooling systems. These investments correspond to a financial multiplier effect of 3.6 and imply that € 3.60 (gross) were invested for each Euro of support granted, see Figure 4.

[1] Up to the year 2017, the total amount has increased to almost € 800 million (BMU 2018).

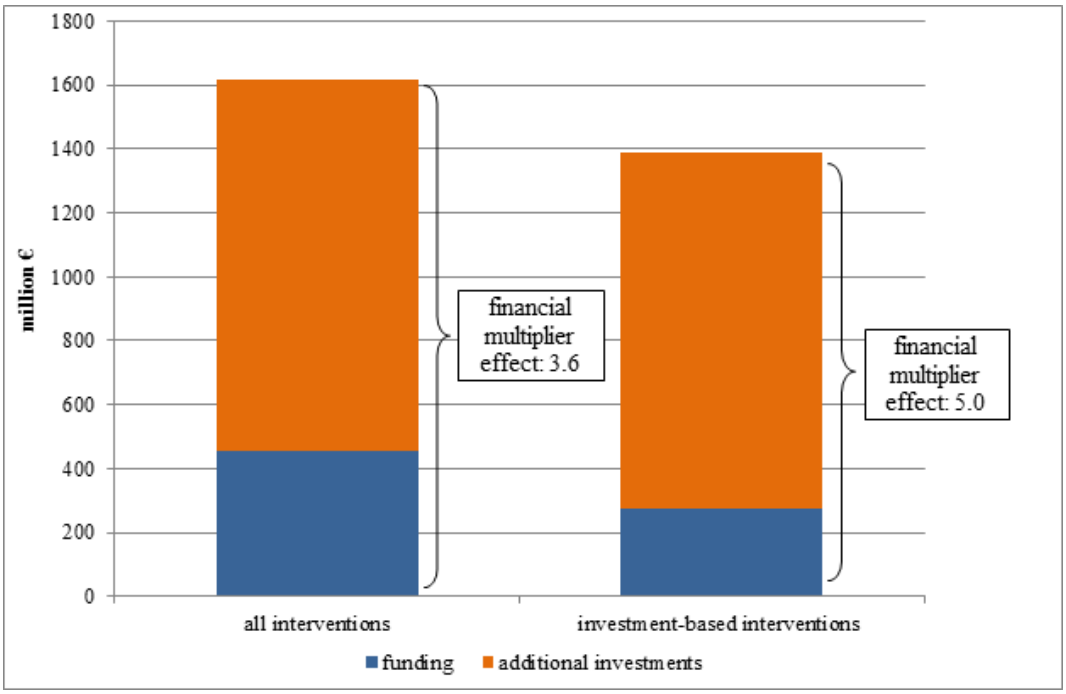

Figure 4: Investments triggered by the NCI

GHG mitigation by cluster

The evaluation assessed that about 9.9 million t of CO_2 over the lifetime were saved thanks to the NCI activities from 2008-2014 compared to a reference development without the funding. About 65 % of these reductions were achieved within the cluster financial support programs, mostly through the stimulus program for micro-CHP plants, the support program for municipalities to install more efficient street and indoor lighting systems and the stimulus program for commercial cooling systems. With 16-17 % of the total GHG reduction over the lifetime each, the provision of knowledge to change investment decisions and specific advice programs also led to relevant GHG reduction, see Figure 5. GHG reductions from information-based interventions were derived – based on the described bottom-up methodology – only for those projects where data or default values were available. As they are overall less reliable than effects from investment-based interventions, they are presented separately and white-patterned in Figure 5. For some of the information-based interventions it was not possible to calculate reliable GHG reductions as data or reference values for the efficiency of the intervention (i.e. for quantifying the actual change in behavior or investment activity induced by the intervention) could not be obtained. Concepts are not shown in this figure as they reveal mitigation potentials which have yet to be realized through implementation of measures.

Overall, GHG mitigation increased substantially over time, as more and more projects were funded and passed from the launch into the implementation phase.

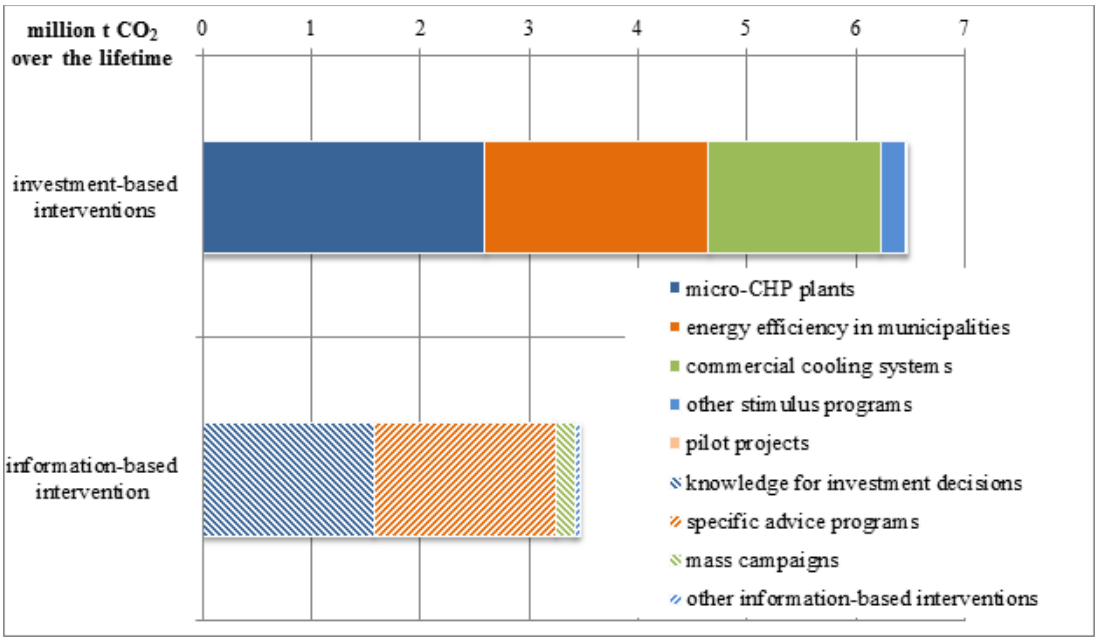

Figure 5: GHG reduction over the lifetime of the funded projects

Further positive effects

Besides the described effects on investments and GHG mitigation, a range of other positive effects were achieved. NCI projects raised awareness and sensitized consumers, businesses and municipalities on climate action, especially through the visibility of the NCI's projects and programs. Activities within the NCI reached a large number of actors, were spread to varying extents all over Germany and were well-tailored to address individual target groups and to serve as models. Furthermore, networks between businesses and municipalities were established to share best-practice, generate new ideas and thus increase the effectiveness of climate mitigation efforts.

With respect to employment, the evaluated projects and programs directly involved more than 10,000 persons (full-time annual equivalents, gross), for example as climate managers or technicians for the installation of the respective equipment. Indirect jobs, for example in the supply industries for renewable energy technologies, micro-CHP and commercial cooling systems amounted to approximately 30,000 so that overall about 40,000 people were directly or indirectly involved on the basis of the NCI in the period from 2008 to 2014.

Effects by target group

The projects and programs of the NCI address four target groups (private consumers, businesses, municipalities and educational institutions) and are designed to meet their specific needs and contexts. Projects and programs for consumers include a stimulus program for micro-CHP plants and several information-based projects e.g. to advice on heating optimization and to save energy. The largest program for businesses was the stimulus program for commercial cooling systems. Businesses were furthermore addressed through stimulus programs for agricultural buildings and hybrid busses, the funding of networks, R&D support, a variety of individual projects, including management tools and more. Within municipalities, the development of municipal climate concepts and designated "climate managers" were funded. Furthermore, investment subsidies for electricity-saving technologies, e.g. efficient street lighting were granted. Additionally, model projects for carbon-neutral municipalities, which included both the concept development and a grant for implementation, were supported. Between 2008 and 2017, the NCI

has promoted about 12,500 projects in more than 3,000 municipalities. To a small extent, energy saving campaigns and other projects in educational institutions were funded since 2011.

Of the € 453 million NCI funding between 2008 and 2014, about 41 % (€ 186 million) were spent on the target group municipalities, about the same amount (40 %, € 180 million) were spent on the target group businesses. With 18 % of the total amount spent within the NCI, the target group consumers got a funding of about € 84 million. Educational institutions received € 3.3 million through the funding program which is less than 1 % of the total funding.

Investments in addition to the funding were mainly triggered for businesses (more than € 690 million), they used e.g. the stimulus program for commercial cooling systems to make a much larger investment in new cooling technologies to save energy, costs and reduce their emissions. Municipalities invested more than € 320 million in addition to the NCI funding and consumers invested more than € 150 million due to funding through the NCI.

Businesses, municipalities and consumers had comparable shares in the **GHG reduction** over the lifetime. With 39 % or almost 3.9 million t of CO_2 most of the GHG reduction was realized in the target group businesses. More than 3.4 million t of CO_2 were reduced in municipalities and more than 2.6 million t of CO_2 were reduced by consumers or in households, see Figure 6.

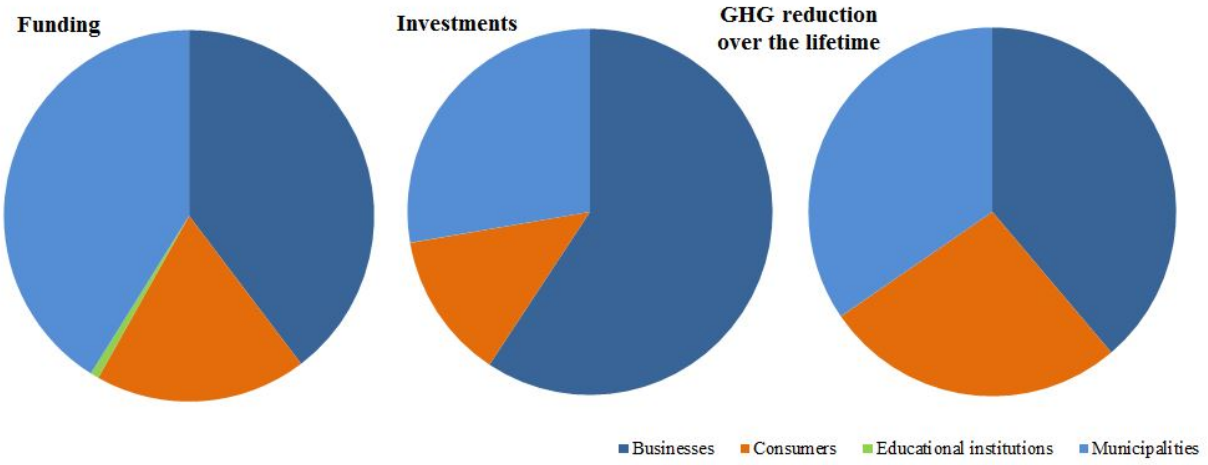

Figure 6: Effects by target group

Conclusions

The success of the National Climate Initiative is notable. The evaluation identified its high flexibility and good steerability (e.g. with the help of continuous evaluation and expert support) as particular strengths which should be used to buttress its further development. These strengths make the NCI an attractive partner for cooperation, e.g. with local authorities, organizations, industrial companies and associations and consumer groups.

From the outset on, the NCI has been stepping on new ground by promoting a multitude of different interventions. It combines novel approaches like a training program for the long-term unemployed in combination with household-level energy saving advisory services for low-income households, with long-standing government programs like the investment subsidies for efficient cooling or heating.

Transformation towards a sustainable society requires fundamental behavioral changes which will inevitably face resistance. A portfolio of different approaches is considered essential to overcome barriers. We found distinct differences in terms of impact between information-based and investment-based policy instruments as well as between the various information-based project approaches. Some

approaches might be reaching a large number of people, but have limited impact on changing behavior. Others affect behavior change, but have only limited effect on reducing greenhouse gas levels. The adopted measures target different energy and emission saving opportunities – both in terms of GHG savings per behavior change and in terms of the quality of this change. Some of the GHG savings may be realized instantly, while other approaches can induce changes only in the medium or even longer time horizon. The sample of interventions was not large enough for a systematic and statistically significant comparison of intervention effectiveness. Nonetheless, our evaluation gives indication for the following hypotheses regarding impacts:

- In order to convey messages and change in behavior, it is more efficient to use those communication and network channels that provide advice anyway and add climate-related information (e.g. product energy efficiency). For example, using well-introduced customer information platforms (www.test.de, www.ecotopten.de) allowed projects to reach customers more effectively than introducing new forms of activities through other channels.
- Generally "soft" measures (information, motivation) for changing one-off behavior (like large purchases) can deliver more climate benefits per intervention effort than soft measures for changing everyday routines (like using public transport instead of your car). While cost per behavior change might be comparable, soft measures for changing routine behavior are likely to have only short impact periods. In addition, the GHG savings per instance of changed behavior are typically very small.
- Different target groups are receptive to different interventions. While the municipalities were initially very receptive to financial support for planning measures and concepts, this changed towards implementation of measures. Consumers were more likely to seek specific information for specific decisions. Businesses seemed to benefit most from networks, best practice and management tools.

The NCI has built on these insights and adapted over the last decade. While initially a large focus was put on developing concepts, pilot projects and strategies, the focus has shifted towards implementation of measures and investment into efficient technology. For municipalities, for example, a substantial share of funding now goes to climate managers who are in charge of implementing mitigation measures. Additionally direct financial support is provided to municipalities for efficient street and indoor lighting. Applications for funding are now required to detail their causal chains based on the bottom-up methodology. This is particularly relevant for projects that qualify as information-based interventions as this allows gaining insights into each project's impact on GHG mitigation and helps monitoring and evaluation.

The NCI benefits from its broad portfolio both in terms of target groups and types of intervention. It manages to tap potentials that are not addressed through more conventional policy instruments (such as energy taxes, emissions trading or other top-down regulations) by means of support measures and activities that are tailored to target groups.

Our evaluation team concluded that the National Climate Initiative is a quick-learning, innovative and effective instrument for climate action in Germany. The evaluation highlights the importance of a consistent monitoring and assessment of policies and measures which is considered essential to promote the effectiveness and efficiency of these measures and to redesign – if needed – in order to keep on track for reaching Germany's goal to shift to a sustainable economy.

References

Abrahamse, W., L. Steg, C. Vlek, and T. Rothengatter. 2005. "A review of intervention studies aimed at household energy conservation". *Journal of Environmental Psychology*, 25(3), 273–291.

BMU. 2018. “The National Climate Initiative Facts and Figures”. https://www.klimaschutz.de/en/facts-and-figures [retrieved 01/03/2018].

BMU. 2007. “Key Elements of an Integrated Energy and Climate Program Decision of German Cabinet on August 23rd/24th 2007 at Meseberg”. http://www.bmu.de/fileadmin/bmu-import/files/english/pdf/application/pdf/klimapaket_aug2007_en.pdf.

BMU and BMWi. 2011. „Der Weg zur Energie der Zukunft – sicher, bezahlbar und umweltfreundlich. Eckpunktepapier der Bundesregierung zur Energiewende.“ http://www.nachhaltigkeit.info/artikel/eckpunktepapier_der_weg_zur_energie_der_zukunft_1545.htm. February 11, 2015.

BMU and BMWi. 2010. „ Energiekonzept – für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung.“ https://www.bmwi.de/Redaktion/DE/Downloads/E/energiekonzept-2010.pdf?__blob=publicationFile&v=3. September 28, 2010.

BMWi. 2014. „Zweiter Monitoring-Bericht ‚Energie der Zukunft‘“. https://www.bmwi.de/Redaktion/DE/Publikationen/Energie/zweiter-monitoring-bericht-energie-der-zukunft.pdf?__blob=publicationFile&v=10. March 2014.

Bürger, V. 2009. „Identifikation, Quantifizierung und Systematisierung technischer und verhaltens-bedingter Stromeinsparpotenziale privater Haushalte“. *TRANSPOSE Working Paper No3*. Freiburg.

CEN (European Committee for Standardization). 2012. “CSN EN 16212 – Energy Efficiency and Savings Calculation, Top-down and Bottom-up Methods”. Brussels.

European Commission. 2005. “Annex to Impact Assessment Guidelines: 15.06.2005”.

MultEE. 2016. “Document with general formulae of bottom-up methods”. http://multee.eu/system/files/D2.1_Document%20with%20general%20formulae%20of%20bottom-up%20methods.pdf. January 28, 2016.

NCI Evaluation Consortium. 2017. “Evaluation of the National Climate Initiative 2012-2014”. https://www.klimaschutz.de/sites/default/files/Gesamtbericht%20NKI-Evaluation%202012-2014.pdf. In German. July 20, 2017.

NCI Evaluation Consortium. 2012. “Evaluation report 2008-2011”. Short and long summary report. http://www.bmub.bund.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/nki_evaluierung_langfassung_2012_bf.pdf. In German. October 19, 2012.

Schumacher, K., M.R. di Nucci, B. Görlach, M. Grünig, C. Heldwein, J. Repenning, S. Rieseberg, K. Tews, C. Wörlen, and H.J. Ziesing. 2014. “Evaluation as a Cornerstone of Policies and Measures for the Energiewende”. In: Brunnergräber A. and Di Nucci M.R. (eds): „Im Hürdenlauf zur Energiewende. Von Transformationen, Reformen und Innovationen“. *Springer Fachmedien.* Wiesbaden. 369-385.

Schumacher, K., J. Repenning, C. Wörlen, S. Rieseberg, C. Heldwein, K. Tews, M.R. di Nucci, B. Görlach, M. Grünig, and H.J. Ziesing. 2013. “Evaluation of the German National Climate Initiative. Lessons learned and steps ahead”, *eceee Summer Study Proceedings*, 1935-1946.

Tews, K. 2009. „Politische Steuerung des Stromnachfrageverhaltens von Haushalten. Verhaltensannahmen, empirische Befunde und Politikimplikationen“. *TRANSPOSE Working Paper No5*. Berlin.

Tews, K. 2005. “The Diffusion of Environmental Policy Innovations: Cornerstones of an Analytical Framework”. In: *European Environment* 15(2): 63-79.

Vreuls, H., S. Thomas, and J.-S. Broc. 2009. “Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services. General bottom- up data collection, monitoring, and calculation methods (WP 4 final summary report)”. Senter Novem, Wuppertal-Institut and Armines.