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Tracking Emissions and Mitigation Actions: Evaluation of MRV Systems in China, Germany, Italy, and the United States

Climate Policy Initiative

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Climate Policy Initiative (CPI) is a policy effectiveness analysis and advisory organization whose mission is to assess, diagnose, and support the efforts of key governments around the world to achieve low-carbon growth.

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Executive Summary

As nations take on increasingly ambitious climate mitigation goals, they face a heightened need to track their greenhouse gas (GHG) emissions and actions to mitigate those emissions. Good tracking systems support effective policy by giving policymakers and stakeholders feedback on progress towards their goals, allowing them to track the performance of policies, and signaling emerging challenges and opportunities for improvement.

This report focuses on systems that measure emissions, estimate the impact of mitigation actions, report those results, and verify that the information is complete and correct. We use the term measurement, reporting, and verification (MRV) to refer to these systems. While institutions vary across different political, social and economic systems, all countries are pursuing some common objectives in terms of climate change mitigation, and all can benefit from effective MRV systems. This report assesses MRV systems for greenhouse gas emissions and mitigation actions in four countries—China, Germany, Italy, and the United States.

To evaluate their effectiveness, we examine the extent to which each country's systems meet a common set of criteria: **TRANSPARENCY, COMPARABILITY, RELIABILITY, USEFULNESS, TIMELINESS, and COMPLETENESS**. Systems with these characteristics are better placed to track progress towards goals and inform policymaking, regardless of the particular national context.

The evaluation yields insights to shared challenges, opportunities, and areas for collaboration, both within and among countries. We encourage all countries to apply the evaluation framework in their own situations; a wider data set should generate more and stronger insights to help all nations improve their MRV systems.

The evaluation in this report is based on CPI's previous report "Tracking Emissions and Mitigation Actions: Current Practice in China, Germany, Italy, and the United States" (February 2012).¹

¹CPI, 2012.

Key Findings

- **EXISTING MRV SYSTEMS ALLOW COUNTRIES TO DETERMINE IF THEY ARE MEETING EMISSIONS REDUCTION TARGETS, BUT DO NOT ALLOW THEM TO IDENTIFY THE MOST EFFECTIVE AND RESOURCE-EFFICIENT POLICIES.** Ideally, MRV systems would allow policymakers to determine which policies are contributing most effectively to climate mitigation goals, and to measure whether policies are achieving their goals cost-effectively. There are major obstacles to achieving this level of performance. It is very difficult to attribute precise outcomes and costs to policies in a constantly changing world; it is also difficult to assess the performance and cost-effectiveness of policies with multiple objectives. However, policymakers must often make decisions about allocating limited public resources with or without this information; improving MRV on this front would be difficult but very beneficial. Policymakers are aware of this challenge and are making attempts to address it—for example, with the European Union's database of energy efficiency measures and impacts.
- **ACROSS THE BOARD, SYSTEMS TRACKING EMISSIONS ARE MORE TRANSPARENT AND COMPARABLE THAN SYSTEMS TRACKING MITIGATION ACTIONS.** The four countries in our study all prepare comprehensive emissions inventories, in connection with the United Nations Framework Convention on Climate Change (UNFCCC) process. All have or are developing significant institutional capacity to prepare emissions inventories, and make efforts to report emissions data in a timely and complete manner. In contrast, there are fewer established good practices for tracking the climate impact of mitigation actions. Methodologies for measuring policy impacts vary, and in contrast to the well-developed systems for inventory preparation, it is not always clear how mitigation estimates are

calculated.

- **TRACKING SYSTEMS ARE STRONGER FOR MITIGATION ACTIONS THAT RELATE TO INTERNATIONAL POLICIES OR MAJOR, MANDATORY DOMESTIC POLICIES.** There are relatively strong MRV requirements for emissions reporting under the UNFCCC, as well as for mitigation actions that connect to European Union requirements. For domestic activities, countries also place a greater emphasis on data reliability for policies that are mandatory and large-scale. Tracking systems are notably weaker for domestic policies that are voluntary or do not involve significant expenditures of public funds; as a result, estimates of the climate-related impact of these programs are less available and less reliable. While this may reflect a reasonable allocation of limited MRV capabilities and resources, it means countries are not well-placed to take a comprehensive look at the effectiveness and efficiency of their climate actions.
- **SOME TRACKING SYSTEMS ARE LEADING—NOT JUST FOLLOWING—THE SETTING OF POLICY TARGETS.** Beyond simply tracking progress toward fixed targets, some tracking systems can inform policy design and the selection of targets. As demonstrated by some systems described in this study, tracking systems are well-equipped to serve this role when they involve an impartial review process, present information in a timely manner, and have a strong institutional connection to the policy development process. (For example, see case study on Germany's feed-in tariff on page 18.) A strong, dynamic MRV system can allow policymakers to continually readjust to find the most efficient and effective policies and make the best use of available resources.

Evaluation of Current Practices

- **CHINA:** China is strengthening its institutional capacity to produce consistent, reliable GHG inventories; until recently

this capacity was very limited. China publishes an annual climate change report that provides a comprehensive view of mitigation actions; of the four countries in this study, it is the only one publishing such a report every year. China also has an extensive system to track energy usage, although reporting is less comprehensive for non-energy activities. However, China's MRV systems lack transparent expert and public review of data and methods. Unless China makes progress on transparency, as it has with other aspects of its MRV systems, the credibility of the system will remain compromised.

- **GERMANY:** The German system for tracking emissions has reached a high level of sophistication and performs well across the six evaluation criteria; the systems to track mitigation actions are somewhat less sophisticated. While there are well-developed systems to track some major individual mitigation actions, Germany's efforts to track its mitigation efforts as a whole suffer from a lack of institutional coordination, which has limited the availability of comprehensive national reporting. Germany's domestic system to track emissions and mitigation actions is primarily driven by the implementation of international and European Union obligations.
- **ITALY:** Italy's GHG emissions inventory system is well-developed, resulting from considerable technical expertise built up in the Italian government during the past ten years. National systems for MRV of mitigation actions appear to be reliable, but they often do not use consistent methodologies when it comes to estimating individual policy impacts; they are driven by heterogeneous requirements laid down in legislation underpinning each policy, harmonized to international standards when explicitly required by supranational legislation. Italy has begun to measure and report

on its energy efficiency policy portfolio in a more integrated and consistent way, although this reporting does not usually include estimates of mitigation impact.

- **UNITED STATES:** The United States' systems to measure, report, and verify its emissions are very strong; they are able to effectively inform domestic and international stakeholders and inform future policymaking. In contrast, the United States' MRV systems for mitigation actions are less able to play this role. The U.S. has no regular process for tracking the impact of its policy portfolio related to climate change mitigation. At the level of individual policies, there are some well-developed systems to track compliance and gather program data, and general oversight mechanisms help ensure the quality of policy-specific MRV systems.

Good Practices

The following specific good practices and gaps emerge from our analysis. These are particular characteristics of MRV systems that, in the experience of one or more countries in our study, seem to contribute significantly to their ability to effectively track emissions and mitigation actions.

TRACKING EMISSIONS

- In the United States, facility-level emissions data are presented in a particularly user-friendly online format and at multiple levels of detail, including by sector, gas, type of facility, and location. The European Environment Agency has a similarly transparent online data viewer for European GHG inventories.
- The United States, Germany, and Italy all publish inventory data in the form of spreadsheets or a searchable database, allowing for further analysis by outside parties.
- In Germany, Italy, and the United States, regular improvements are made to the methodology for measuring emissions, and when estimation methods are updated, the new methods are applied to previous years to allow for comparability,

with a clear explanation of any changes.

- In China, entities preparing emissions inventories have adapted international methods to national circumstances; for example, by developing new processes to collect data from sectors where prior data collection was irregular or unreliable.
- Germany and Italy use emissions data from facilities covered by the European Union Emissions Trading System to cross-check data collected for their GHG inventory.
- In Germany, Italy, and China, emissions trends and levels are broken down at the level of sub-national governments, to facilitate policymaking at multiple levels of government.

TRACKING MITIGATION ACTIONS

- China publishes comprehensive progress reports on mitigation actions, providing regular public updates on policies and their outcomes in a format that allows for aggregation and comparison of emissions reductions attributed to different policies.
- In its reporting on energy and climate actions, Germany publishes the results of pre-implementation modeling of policy impacts, describing methodologies and potential sources of uncertainty in detail.
- Through government oversight bodies, the United States publishes balanced assessments of mitigation actions that include negative as well as positive information, providing an unbiased look at policy performance and allowing for programs to be improved (see case study on page 31).
- Italy has begun providing post-implementation evaluations of energy savings and cost-effectiveness of its energy efficiency policies, within the framework of its national energy efficiency action plan.
- Germany convenes working groups, including outside experts, to evaluate methodologies for estimating the emissions impact of mitigation actions.

All four countries have room to improve—especially on tracking the performance of mitigation actions, where the underlying analysis is more difficult and there is currently less standardization of methods across and within countries. The specific priorities for improvement in each country depend on what new MRV needs are emerging from international and domestic policy processes. In a forthcoming study, CPI will assess how well-positioned each of these four countries is to meet its own emerging needs for MRV, and what specific actions each could take to best meet its MRV needs in the future.

Introduction

Nations are engaging in climate change mitigation actions with gradually increasing scope and stringency, increasing the importance of effectively tracking greenhouse gas (GHG) emissions and mitigation actions. Measurement, reporting, and verification (MRV) systems provide information on the trajectory of emissions and the effectiveness of mitigation actions; good tracking systems thus expand nations' capacity to meet the challenge of averting dangerous climate change. Strong MRV systems can help make policies more efficient and effective, while weak MRV can undermine policy objectives, lead to waste of public resources, and diminish public confidence.

Countries engage in MRV whenever they measure emissions, estimate the impact of mitigation actions, publish emissions inventories, issue reports on their climate change mitigation efforts, or attempt to verify the accuracy of data on emissions or policy performance. These actions allow policymakers and the public to find out if governments are meeting their current mitigation goals—whether those goals are stated formally or informally, within or outside the context of international negotiations. MRV also allows countries and sub-national governments to learn from each other's experience, by illuminating which policies are working effectively to reduce emissions and which are not. Strong tracking systems also increase the confidence of the domestic public and international community in a country's claimed mitigation outcomes, strengthening collective support for climate action.

This report analyzes domestic MRV systems for emissions and mitigation actions in four of the major emitters—China, Italy, Germany, and the United States. The four countries studied here have long engaged in MRV of emissions and mitigation actions. Their domestic MRV systems represent a wide range of practices evolving around the different domestic and international obligations each country faces. An analysis of such a wide spectrum of MRV practices not only allows us to identify what works and what doesn't, but also provides important insights for individual

WHAT IS MRV?

Measurement, reporting, and verification are terms that refer to three key elements of the policy infrastructure needed to monitor and track performance. Although different terms are used across domestic and international policy discussions, this paper defines "MRV" broadly, based on the following concepts:

Measurement refers to direct measurement of emissions, abatement, or some other outcome and to estimation based on proxy indicators or data.

Reporting refers to the presentation and transmission of data, measurements, and associated analysis.

Verification refers to the evaluation of the emissions, abatement, and other information that is measured and reported.

We also define "MRV system" broadly, to cover any institutions or official processes through which countries measure, report, and verify emissions and mitigation actions.

countries to further strengthen their domestic MRV systems.

Institutions vary across different political, social and economic systems. Nevertheless, all of the countries in our study are pursuing some common objectives in terms of climate change mitigation, and all benefit from systems that track progress towards their goals, inform policymakers and other stakeholders about that progress, and feed lessons back into the policymaking process. We have identified a small set of common criteria that support these outcomes, based on a review of the relevant literature and interviews with international and national MRV experts. We hope this evaluation yields valuable insights into shared challenges, opportunities, and areas for collaboration, both within and across countries.

The evaluation described in this report is based on CPI's previous report "Tracking Emissions and Mitigation Actions: Current Practice in China, Germany, Italy, and the United States" (February 2012). In the next phase of this study, CPI will assess the adequacy of these systems in meeting emerging domestic and international demands for MRV. CPI has also examined methods for evaluating the effectiveness of climate finance, in collaboration with the Environmental Defense Fund, the Brookings Institution, and the Overseas Development Institute ("Improving the Effectiveness of Climate Finance: Key Lessons," November 2011).

The report is structured as follows. First, we describe the methodological framework used for our evaluation, including a set of six common criteria for effectiveness of an MRV system. We then evaluate each country's domestic MRV systems against the framework. For each, we outline the general national context and key strengths and weaknesses of its systems for tracking emissions and mitigation actions, and then assess the extent to which the country's systems meet the six common criteria for effective MRV. We provide three case studies (on the German feed-in tariff, the European Union Emissions Trading System, and the United States' Energy Star product labeling program) that

include examples of both effective and ineffective MRV systems, illustrating the importance of the six characteristics of effective MRV systems in varying domestic policy contexts. We conclude with a synthesis of the status of MRV in the countries examined, highlighting good practices and common challenges.

Methodological Approach

There is no standard approach to evaluating the effectiveness of MRV systems. This report presents our own approach, which we developed drawing on existing literature and expert input. Our goal was to develop a framework for evaluation that is consistent, systematic, and transparent, and can be applied to different systems in different policy environments. We encourage others to apply the evaluation framework in their own countries; a wider data set should generate more and stronger insights to help all countries improve their MRV systems.

Our approach to evaluating effectiveness begins with identifying the basic objectives of a tracking system. While specific national contexts differ, all domestic MRV systems are designed to meet the following three objectives to some degree:

- I. **TRACKING ACHIEVEMENT OF EXISTING POLICY TARGETS:** Countries pursuing emissions reductions targets need to know if they are taking appropriate actions and meeting their own policy objectives with respect to GHG emissions.
- II. **INFORMING FUTURE POLICYMAKING:** Policy operates within a dynamic environment; even a well-designed policy portfolio will need to be adjusted over time. Emissions data and policy tracking can inform the adjustment of current policies and influence the design of future measures by providing an accurate picture of performance and trends. Good data can also help identify where additional mitigation support may be required, both across countries and at the sub-national level.
- III. **INFORMING DOMESTIC AND INTERNATIONAL STAKEHOLDERS:** To guide their own decisions, stakeholders at both the domestic and international levels need to have confidence in

a country's emissions data and claimed policy outcomes.

We then identified six characteristics of MRV systems that are essential to meeting these objectives. In developing this list of criteria, we drew from guidelines established by the United Nations Framework Convention on Climate Change (UNFCCC) for the preparation of parties' National Communications, as well as a review of other literature on the subject and discussions with national and international experts.² Based on this review process, we identified the following six common criteria:

- **TRANSPARENCY:** Is the process open, accessible, and comprehensible to relevant audiences?

The more accessible a system's data and methodologies, the more open the system is to having its results tested and scrutinized by the public (including civil society and other associations), and the data itself checked for anomalies. Transparent MRV systems increase the credibility of reported information and allow stakeholders to hold policymakers accountable for meeting targets.

- **COMPARABILITY:** Is information comparable across time, agencies, and different levels of government? Is it comparable to other countries' data or reports?

Consistency in how data are calculated and presented allows estimates of emissions, or of the impact of mitigation actions, to be added together or compared to each other, and facilitates learning across agencies and countries. Although changes in methods may indicate an evolving and improving system, mixing methods over time without any explanation or retroactive application makes evaluation of GHG inventories and mitigation actions difficult.

- **RELIABILITY:** Is information likely to be accurate?

² Sources consulted include: Herold, 2003; Larsen, 2010; Todorova et al., 2003; UNFCCC, 2000; UNFCCC, 2003.

Both policymakers and outside stakeholders depend on receiving data that are accurate and unbiased. Elements of MRV system design—such as relying on well-vetted methodologies, building staff expertise, and opening up processes to third-party or expert review—can make it more likely that the system produces accurate information.

- **USEFULNESS:** Does the MRV system connect to the policymaking process?
An MRV system can only lead to future policy improvements if the information produced by the MRV system feeds back into the policymaking process in some way.
- **TIMELINESS:** Is information collected and delivered frequently enough to support decision-making and meet other needs?
An MRV system is better able to inform the policymaking process, and facilitate oversight by stakeholders and the public, if it delivers information in a timely manner.
- **COMPLETENESS:** Does the system provide sufficient information to support decision-making in all important sectors?
While some sectors and gases contribute more to climate change than others, MRV systems can provide a clearer picture of current status and more accurately inform future action if they are comprehensive.

All six of these criteria are important determinants of the effectiveness of tracking systems across a variety of policy contexts.

For each of these six criteria, we selected a set of indicators representing specific, observable features that, if present, make it more likely that a system meets a particular criterion. The indicators for each of the six criteria are listed on the following page. We evaluated the presence of each indicator based on both formal rules and actual implementation.

To gauge the extent to which criteria are met, we use a scale, which can be read as follows:

- **VERY** (transparent, comparable, reliable, useful, timely, or complete): All or almost all of the indicators are present in the country's MRV system.
- **FAIRLY**: Most indicators are present, but some are missing or only partially present.
- **SOMEWHAT**: Some indicators are present but others are not; or indicators are present, but only to a limited extent.
- **NOT VERY**: Some indicators are present but most are not.
- **NOT AT ALL**: None or almost none of the indicators are present.

This report presents an overall assessment of each country's domestic systems for tracking emissions and mitigation actions. We provide separate assessments of systems for tracking emissions and systems for tracking mitigation actions, as these are distinct processes in all four countries in our study. Our findings on the presence of each indicator in each country are described in depth in an appendix to this paper, available at CPI's website. The assessment of each country's MRV systems was finalized after consultation with relevant in-country stakeholders.

OBJECTIVES	TRACK ACHIEVEMENT OF EXISTING POLICY TARGETS INFORM FUTURE POLICYMAKING INFORM DOMESTIC AND INTERNATIONAL STAKEHOLDERS					
CRITERIA	Transparency	Comparability	Reliability	Usefulness	Timeliness	Completeness
<p>INDICATORS</p> <ul style="list-style-type: none"> • Are underlying data publicly available for review and use? • Are data collection and/or emissions estimate methodologies publicly available and clearly described? • Is transparent expert review part of the reporting process? • Is there a clear identification of sources of uncertainty and methods for measuring it? • Does the system include standardized documentation of methods and key decisions, and strong record-keeping practices in general? Are there consistent procedures for archiving results and documents? 	<ul style="list-style-type: none"> • Are consistent calculation and reporting methods employed over time, agencies, different levels of government, sectors, and/or policies? • If methodological changes are made, are they applied to previous years' data? • Does the system use internationally accepted units, protocols, methods, etc.? 	<ul style="list-style-type: none"> • Are data collected, and are estimates made, based on sound, well-established, widely accepted methods? • Are data accessible and subject to third-party or public review? • Is the system itself—meaning the institutional and procedural apparatus responsible for developing emissions/mitigation estimates—subject to review either internally or by third parties? • Are data sources likely to be unbiased and accurate? • Is there a process for adopting the most up-to-date methods or otherwise improving estimation methods over time? Are previous emissions and mitigation estimates recalculated using updated methodologies? • For all significant sources of emissions, are methods the most sophisticated available? • Does the system include a process for developing and maintaining institutional capacity over time—for example, through a dedicated, permanent staff with relevant expertise? 	<ul style="list-style-type: none"> • Is there a clear mechanism for feeding information back into the policymaking process? • Is there strong integration in the institutional structure between policymaking and data collection? • Is information presented in different formats and at different levels of technical detail? • Are data used in quantitative analysis related to policymaking? 	<ul style="list-style-type: none"> • Does data collection occur on a regular schedule? • Does reporting occur on a regular schedule? • Is information collected and delivered frequently enough to provide policymakers (and other relevant audiences) a solid understanding of national circumstances/trends or policy performance? 	<ul style="list-style-type: none"> • Are all relevant sectors covered? • Are all relevant gases covered? • Are all years since the base year covered? • Are all relevant source categories covered? • Is geographical coverage complete? 	

China

Background and Reporting Activities

China's focus on climate change has increased significantly in recent years. During the 11th Five-Year Plan (FYP) period (2006–2010), China set a mandatory target of reducing national energy intensity by 20 percent from 2005 levels and achieved a 19.1 percent reduction by the end of 2010.³ In the 12th FYP (2011–2015), China has committed to reduce energy consumption by 16 percent and carbon intensity by 17 percent from 2010 levels.⁴ The carbon intensity target will contribute to the Chinese government's goal of reducing carbon emissions per unit of GDP by 40–45 percent by 2020 from 2005 levels.⁵ The government has implemented a range of policies and programs to reduce emissions and enhance sequestration, and is taking actions to improve its methodologies and institutional capacity to track GHG emissions and mitigation action outcomes, especially in the energy-related sectors.

China has international reporting obligations as a non-Annex I party to the UNFCCC. The preparation of China's national GHG inventory has been largely driven by international obligations rather than domestic needs; only one inventory has been published to date. A number of factors (e.g., weak statistical foundation, limited scope, observations and sampling with little representativeness) resulted in substantial uncertainty in China's first national inventory, which covered 1994 emissions and was published in 2004. However, China is making significant improvements in its capacity to prepare national GHG inventories, such as by establishing a national GHG inventory management system as it prepares its Second National Communication (to be released in 2012). This management system is meant to ensure the quality and sustainability of the inventory compilation. Moreover, all provinces are expected to prepare provincial GHG inventories for the year of

2005; this will provide a baseline for tracking the provincial-level implementation of the national carbon intensity target during the 12th FYP and subsequently allow the central government to track their implementation progress. The preparation of local GHG inventories, if completed as planned, will generate disaggregated emissions data to both inform and cross-check the accuracy of the national inventory.

China is systematically tracking its mitigation actions and outcomes, and publishes an annual progress report on climate change policies and actions. Three annual progress reports have been released since 2008.⁶

This chapter evaluates China's existing systems for tracking its emissions and mitigation actions. Strong domestic MRV systems will help China meet emerging domestic needs, such as its emissions intensity reduction targets for 2015 and 2020. Strong domestic MRV systems will also position China to respond quickly to its evolving international commitments, such as preparing and submitting GHG inventories to the UNFCCC every other year.⁷ Our evaluation is based on the following three elements, which are the primary mechanisms China is employing to measure, report, and verify its emissions and mitigation actions:⁸

- The preparation of China's 1994 (first) emissions inventory and 2005 (second and forthcoming) emissions inventory;
- Three annual progress reports on China's climate policies and actions (2008, 2009, and 2010);
- The Statistics Indicators, Monitoring, and Examination (SME) system of energy statistics underpinning China's inventories and most of its mitigation actions.

⁶ Ibid.

⁷ The Cancun Agreements state that non-Annex I countries, including China, should submit biennial national inventory updates "consistent with their capabilities and the level of support provided for reporting."

⁸ Our evaluation does not review the emission monitoring, reporting, and verification systems the Chinese government has put in place for major water and air pollutants.

³ People's Republic of China, 2006; General Office of the State Council, 2011

⁴ People's Republic of China, 2011.

⁵ NDRC, 2010.

Tables 1.1 and 1.2 provide an overview of the domestic systems for tracking emissions and mitigation actions in China.

Table 1.1: Systems for Tracking Emissions

SYSTEM	GHG INVENTORY
MEASUREMENT	1st inventory covered three primary GHGs: CO ₂ , CH ₄ , N ₂ O; using accepted international guidelines; methods ranging from country-specific to more general; additional data gathered as needed. 2nd inventory will include six primary GHGs
REPORTING	1st Inventory, for 1994, was completed in 2004; data publicly available in print 2nd Inventory, for 2005, is forthcoming in 2012
VERIFICATION	Internal expert review; qualitative uncertainty analysis

Table 1.2: Systems for Tracking Mitigation Actions

SYSTEM	NATIONAL COMMUNICATIONS	STATISTICS INDICATORS, MONITORING, AND EXAMINATION (SME) SYSTEM	CHINA'S POLICIES AND ACTIONS FOR ADDRESSING CLIMATE CHANGE—THE PROGRESS REPORT
MEASUREMENT	List of mitigation actions. Some quantitative estimates of impact in terms of energy saved, but not in terms of GHG emissions.	Energy production: comprehensive survey Energy circulation (transmission and distribution): local statistical bureaus and relevant industrial associations collect data for each category Energy consumption: data collected from industries	Estimates of mitigation outcomes either in terms of energy savings or carbon reduction.
REPORTING	First National Communication completed in 2004; provides information on mitigation actions and estimated outcomes; publicly available online Second National Communication is still in preparation.	Several types of energy reporting varying in frequency and level of detail. Annual energy reports include more indicators, wider statistical scope, and more statistical categories. Comprehensive energy reports are prepared by bureaus of statistics at the provincial level.	Present a suite of mitigation-related policies and programs as well as some estimated mitigation outcomes.
VERIFICATION		Upper-level statistics bureaus verify data from lower-level bureaus. National, provincial authorities oversee data from largest enterprises; local governments monitor other enterprises.	

	EMISSIONS	MITIGATION ACTIONS
TRANSPARENCY	SOMEWHAT TRANSPARENT	NOT VERY TRANSPARENT
COMPARABILITY	SOMEWHAT COMPARABLE	SOMEWHAT COMPARABLE
RELIABILITY	SOMEWHAT RELIABLE	SOMEWHAT RELIABLE
USEFULNESS	FAIRLY USEFUL	FAIRLY USEFUL
TIMELINESS	NOT VERY TIMELY	FAIRLY TIMELY
COMPLETENESS	SOMEWHAT COMPLETE	FAIRLY COMPLETE

Evaluation of Domestic MRV Systems

Overview

China’s systems to track GHG emissions are not very strong, though China is currently making significant efforts to improve the quality of data sources and methodologies. China has finished only one GHG inventory, as part of its first National Communication to the UNFCCC. While this meets China’s international obligations, it does not provide timely and useful information to inform domestic policymaking. Transparency is also lacking; the lack of public or non-governmental expert review of inventory data reduces their reliability. However, China is strengthening its institutional capacity to produce consistent, reliable inventories in the process of preparing its second national inventory and National Communication. Provinces and key cities are expected to develop their first local inventories for the year 2005.

China’s most direct effort to track and evaluate its GHG mitigation actions is its annual progress report on climate change. The report has become significantly more detailed every year since its first publication in 2008. The three progress reports (2008–2010) summarize mitigation actions and provide performance data (both qualitative and quantitative) on mitigation outcomes. However, the reports provide little information on

data sources and methodologies. Moreover, China has little systematic evaluations of mitigation outcomes at the agency and sub-national levels.

China’s most important mitigation actions relate to its energy-saving targets. The SME system, formulated by the National Development and Reform Commission (NDRC), enables national and local governments to systematically track the performance of their energy conservation policies and targets in a timely way. At the local level, the reliability of energy data is uncertain, as local officials may have some incentives to falsify data, and review systems are fairly weak in practice. Systems to track mitigation actions in non-energy sectors, such as agriculture and forestry, are poorly defined.

Detailed Assessment: Tracking Emissions

1) Transparency: **SOMEWHAT TRANSPARENT**

China’s GHG inventory has a certain degree of transparency: The inventory data are available on the UNFCCC website as part of China’s initial National Communication. Most of the underpinning activity data and emissions factors included in the 1994 inventory are publicly available in print, and several public documents explain the data collection and estimation methods involved in the inventory. However, documentation on the

detailed data sources and methodologies involved in the first inventory are difficult to obtain.

There is little description of quality control or quality assurance procedures applied in the inventory preparation, making it difficult to judge whether China had such procedures in place and how effective the system was. The uncertainty analysis yielded mostly qualitative results with little quantified research; methods for such analysis are not published. Moreover, the first inventory was submitted for internal expert review, but neither the process nor outcomes are public. No evidence indicates that China's inventory system has kept standardized documentation of methods and key decisions.

Since the second inventory is still in preparation and detailed information is not yet available, it is unclear whether the transparency of China's GHG inventory will be improved significantly. There is little publicly available information on the preparation of provincial and city-level inventories.

Energy data are more transparent; this is important, as energy accounts for the majority of China's emissions. Data from 1996–2011 are publicly available for free in the Energy Statistics Yearbook, on the website of the National Bureau of Statistics (NBS). Data sources and survey methods are detailed in a separate document.

2) Comparability:

SOMEWHAT COMPARABLE

The first inventory was prepared in accordance with international guidelines.⁹ Emissions estimates are comparable across sectors and gases to a certain degree; e.g., emissions are reported in carbon dioxide equivalent (CO₂e) terms, allowing comparison and summation across gases. However, it is uncertain whether reports and calculation methods used will be comparable over time, as China has only released one inventory and the second one is still in preparation. It is not known whether the 1994 emissions will be recalculated in the second inventory.

China's inventory preparation team has had to

⁹ IPCC, 1996.

adapt the standard Intergovernmental Panel on Climate Change (IPCC) methodologies in some cases, increasing the completeness and comparability of inventory data. For example, the IPCC guidelines require some types of data that had not been previously collected in China. The inventory team designed over 1,000 questionnaires during the first inventory preparation to collect information on activity data and emission factors from the sectors where routine collection of relevant data were unavailable or the data reliability was poor. However, additional data collection during the first inventory preparation has not changed the routine data collection practice in China, so the comparability of data remains an issue. Chinese statistical scopes and definitions in some sectors differ from the IPCC standards, such as in classification of types of fossil fuels.

China's energy balance sheet differs from internationally accepted energy balance systems in multiple aspects. For example, China adopts a factory approach when collecting energy data, which means that gasoline and diesel consumed by cars and trucks belonging to an industrial enterprise are included in the industry sector rather than the transportation sector. By contrast, international associations such as the International Energy Agency (IEA) generally adopt an end-user approach, under which energy consumed by an industrial enterprise's cars and trucks is included in the transportation sector. These differences create methodological obstacles for compiling GHG emissions inventories. Similar issues arise in other countries; indeed, variations in national practice are a common challenge in comparative analysis.

3) Reliability:

SOMEWHAT RELIABLE

China uses data collected by NBS, industrial associations, and professional organizations to construct emissions estimates. It has made great efforts to improve estimation methodologies, such as collecting additional data for calculating country-specific emissions factors. China has not yet developed sufficient and permanent staff expertise and capacity, as it has only completed one inventory as of early 2012, but significant

improvements in staff expertise and capacity are underway. Institutional continuity is expected to strengthen in the near future, as China may start to produce an inventory every other year, contingent on its capabilities and the provision of international support.

In the preparation of the first inventory, China used IPCC methods whenever applicable. Country-specific emissions factors were used when data were available (e.g., for estimates of waste disposal), while the default emissions factors (an IPCC tier 1 method) were used when collection of additional data was not practicable. Most underlying data used in the first inventory are publicly accessible, but there was little review of the data, estimates, and the inventory system itself by the public or third-party experts (either inside or outside China).

The quality of energy data, which underpins China's inventory preparation, varies greatly. National and provincial level energy data are more accurate, because the number of energy suppliers is small, making energy data collection easy. Separate collection of supply and consumption data allows cross-checking to improve data quality. However, energy data at the sectoral level are less accurate.

China has adopted a suite of measures, including the SME system of energy statistics, to enhance its statistical data collection and quality. Linking local leaders' performance evaluation (a basis for career advancement) to the accomplishment of energy-saving targets has increased the availability of local energy data. However, without stringent verification of reported data, this type of linkage may provide an incentive for reporting entities to falsify data, reducing actual or perceived reliability.¹⁰ Penalties have been put in place to prevent data falsification, but their enforcement is lax in practice.

¹⁰ The pervasive incentives that holding local leaders accountable for meeting priority targets (e.g., energy saving and emission reduction targets) has created for data falsification are extensively discussed in Minzner, 2009.

4) Usefulness:

FAIRLY USEFUL

Chinese policymakers have historically relied on NBS statistical data and the analysis based on the NBS data. The Energy Research Institute (an affiliate of NDRC) leads China's inventory preparation and has long served as a quasi-government think-tank for the country's policymakers; it relies heavily on NBS data for emissions estimates. The first inventory helped China to identify a baseline of national GHG emissions; preparation of provincial inventories will provide an important baseline for provinces' carbon intensity reduction targets and for verifying their progress toward those targets over the next five years. China's inventory preparation explicitly aims to inform future climate policymaking.

The emissions data of the first inventory were presented in a highly aggregated and less user-friendly format: for example, in print but not in electronic format. In addition, the interval between publication of China's inventories has been very long. As a result, the inventories have not been providing policymakers useful information on emission trends, policy impact, or emerging opportunities and challenges. This is likely to change in the future, as China moves to biennial inventory reports.

5) Timeliness:

NOT VERY TIMELY

China's infrequent preparation of the inventory does not provide a solid understanding of national emissions trends. China has as yet only published one inventory, covering emissions from 1994, and the second inventory, due to be published in 2012, will provide emissions data from 2005. However, NBS, which provides activity data on most sectors needed for the inventory preparation, releases the China Statistical Yearbook annually; energy data are reported monthly or quarterly. China also uses sectoral data from other agencies and sources, such as the National Forest Resources Survey, which is conducted once every five years. Government agencies and others can use this information to estimate emissions when needed. However, emissions factors are not updated regularly.

6) Completeness:

SOMEWHAT COMPLETE

No inventory data are available for the years between 1994 and 2005. The first inventory covered carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O), while the second inventory will cover all six major gases, which also include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). The first inventory estimated emissions for all sectors and relevant source categories and sinks, but at a highly aggregated level. Although the preparation team used detailed and disaggregated data to calculate emissions, sub-sectoral detail was very limited in the Initial National Communication. The second inventory will include more disaggregated data for sub-sectors and expand the geographical coverage of the inventory to include the Hong Kong and Macau special administrative regions; however, that inventory is still in preparation and more detailed information is not yet available.

NBS recently announced that it will begin reporting more frequently on GHG emissions and energy consumption in the near future.¹¹

Detailed Assessment: Tracking Mitigation Actions

1) Transparency:

NOT VERY TRANSPARENT

Although the first National Communication, published in 2004, summarized mitigation actions and some estimated outcomes, systematic reporting on mitigation actions and outcomes started in 2008. The three annual progress reports released so far are publicly available online in both English and Chinese. Most information on mitigation outcomes focuses on compliance with a policy, or a policy's progress toward its own goals; some program-level information include data on emissions. However, the progress reports provided little information on the data underpinning their mitigation estimates or the methodologies by which those estimates are calculated.

The release of energy data does not include information on data collection and quality control methods. When data verified on a preliminary basis are later revised, NBS usually attributes revisions to the changes in the scope of statistical analysis, but does not provide details of those changes.

There is no third-party expert review of MRV systems for mitigation actions, but there is a system of intergovernmental review. Review processes are stronger under the SME system: the provincial governments organize expert teams to examine on-site the progress of mitigation actions of lower-level governments and enterprises in their jurisdiction. NDRC then organizes a national expert team to examine the progress of provincial governments. The results of these examinations are available to the public.

Most MRV systems for mitigation actions do not identify sources of uncertainty.

2) Comparability:

SOMEWHAT COMPARABLE

The progress reports include a relatively consistent reporting framework that covers major mitigation policies and actions. The level of detail is increasing, as the latest report in 2010 contains information on the impact of sectoral and local mitigation actions. Since the methods for estimating mitigation impacts are not available, it is unclear if consistent calculation methods have been used over time and whether emissions impacts reported can be summed or compared across programs.

China's energy data uses consistent data reporting methods, has relatively steady calculation methods, and involves regular revisions of previous data. The data are internally consistent, although they are not very comparable to other countries' data at the sectoral level.

Most mitigation estimates are reported in standard, internationally accepted units (e.g., tCO₂e).

¹¹Wei, 2012.

3) Reliability:

SOMEWHAT RELIABLE

The progress reports do not publish the methods used to estimate the impact of mitigation actions, making it difficult to judge reliability of those estimates. Third party audits are conducted for mitigation actions within energy-related sectors that provide subsidies or have binding targets; public and third-party reviews of other mitigation estimates do not exist. The progress reports are prepared by NDRC, and the reporting system is not subject to third-party review. In addition, while there is strong inter-governmental review in the SME system, there is no evidence of any third-party review.

The quality of energy data varies greatly: energy production data has the highest quality, followed by energy circulation (transformation and distribution) data, while energy consumption data has the lowest quality. Moreover, the SME system linking local leaders' performance evaluations directly to the accomplishment of energy-saving targets provides incentives for data falsification; with weak enforcement of the penalties for misreporting, such linkage raises doubts about the reliability of energy data and the mitigation estimates based on that data.

4) Usefulness:

FAIRLY USEFUL

The progress reports provide a relatively solid, high-level, non-technical overview of current mitigation actions and their outcomes and have clear and direct policy relevance at the national level. The results from the SME system direct China's policy-making in the energy-related sectors: policymakers closely track progress against the mandatory energy-saving targets and adjust efforts in response (including increasing effort where required). There is little evidence of strong

linkages between policymaking and data collection in other sectors.

The progress reports do not include any cost-effectiveness analysis of mitigation actions, so they do not provide policymakers with information to improve the efficiency of the policy mix.

5) Timeliness:

FAIRLY TIMELY

The annual progress reports not only summarize mitigation policies and actions but also include qualitative, and sometimes quantitative, estimates of mitigation outcomes for many mitigation actions. The information in the progress reports provides policymakers and the general public with an overall understanding of mitigation actions and their outcomes.

Under the SME system for energy data, data collection and submission to policymakers are frequent enough for them to track policy performance and impacts in a timely manner. The energy-saving data are released quarterly to the public, making it possible for the general public to keep track of policy progress.

6) Completeness:

FAIRLY COMPLETE

The progress reports cover policies across all major sectors affected by mitigation actions. The available mitigation estimates usually cover carbon emissions; other gases are rarely mentioned, except for CH₄ in the agricultural sector. Mitigation estimates are not available for many programs in the report.

Unlike the energy-related sector (for which the SME system serves as its MRV system), adequate MRV systems do not exist for mitigation actions in other sectors. Non-energy sectors generally do not have mandatory mitigation-related targets.

Germany

Background and Reporting Activities

Germany has firm targets for economy-wide emissions reductions. Under the Kyoto Protocol and the EU burden-sharing agreement, it has committed to reducing its GHG emissions by 21 percent during the Kyoto commitment period (2008–2012) relative to 1990 levels. Germany has also set a national emissions reduction target of a 40 percent reduction by 2020 relative to 1990 levels.

Germany has implemented a series of national programs to achieve these goals: the Integrated Energy and Climate Program (IEKP) was adopted in 2007, and the 2011 Energiewende (energy transformation) laws accelerated the move to a

highly efficient and primarily renewable energy supply by 2050. The Federal Government is on track to achieve its targets through a range of mitigation actions—primarily the renewables feed-in tariff, energy conservation through energy efficiency, and the European Union Emissions Trading System (EU ETS).

The main actors involved in tracking GHG emissions and mitigation actions in Germany are the National Coordinating Committee made up of federal ministries, the Federal Environment Agency (UBA), the Working Group on Energy Balance, the Working Group on Renewable Energies, and the Federal Statistical Office.

Tables 2.1 and 2.2 summarize Germany’s systems for tracking emissions and mitigation actions.

Table 2.1: Systems for Tracking Emissions

SYSTEM	GHG INVENTORY
MEASUREMENT	Six primary GHGs; use accepted international guidelines. Peer review of methodologies.
REPORTING	Annual; data online in English and German.
VERIFICATION	Verifying energy data with emissions trading data; part of quality control/assurance process automated; UNFCCC expert review.

Table 2.2: Systems for Tracking Mitigation Actions

SYSTEM	NATIONAL COMMUNICATIONS	EU MONITORING MECHANISM	INTEGRATED ENERGY AND CLIMATE PROGRAM (IEKP)	INDIVIDUAL POLICY TRACKING SYSTEMS
MEASUREMENT	Sectoral measurement of framework data. Primarily pre-implementation modeling of sectoral mitigation action impacts.	Same as for National Communication	Post-implementation data collection and comparison with pre-implementation studies on costs, mitigation impacts of the 29 mitigation actions within the IEKP.	Monthly for renewables by the Working Group for Renewable Sources. Varying degree of institutionalized data collection for other policies. No comprehensive legislation governing data collection and monitoring for some mitigation actions.

SYSTEM	NATIONAL COMMUNICATIONS	EU MONITORING MECHANISM	INTEGRATED ENERGY AND CLIMATE PROGRAM (IEKP)	INDIVIDUAL POLICY TRACKING SYSTEMS
REPORTING	National Communication on policies and measures status, type of policy instrument, and pre-implementation emission reduction projections. Timing subject to UNFCCC decisions.	Biennial reporting on all climate plan measures to the European Commission. Commission reports annually on EU Member State progress to the European Parliament and Council, with support of the European Environment Agency (EEA).	One-time report conducted by UBA. To be replaced by reporting on the Energiewende (energy transformation) laws.	Three times per year for renewables in general. Every four years for the feed-in tariff.
VERIFICATION	Internal verification of post-implementation scenarios through ministerial consultation. Further review by external UNFCCC review teams.	European Commission reviews, with support of EEA, progress reports by Member States.	No third-party verification of the first climate program status report.	On renewables, expert verification through working group members. In general, mitigation actions, especially those where financial outflows pay a role, are audited by third parties.

Evaluation of Domestic MRV Systems

Overview

Germany’s systems to track emissions and mitigation actions are primarily driven by international and European Union obligations. An exception is the tracking systems for renewable energy measures, including the feed-in tariff; these are primarily domestically driven.

Germany has international reporting obligations as an Annex I party to the UNFCCC and GHG mitigation targets as a party to the Kyoto Protocol. The German system for tracking emissions has reached a high level of sophistication and performs well across the six evaluation criteria. Institutional arrangements are oriented toward following IPCC guidelines. Most data collection procedures are based on long-term data provision commitments (e.g., with the Working Group on Energy Balances) and are transparently described in the national inventory report. The system has

well-qualified permanent staff to respond to and organize internal and external reviews, such as EU cross-country peer review and UNFCCC expert review teams.

The system to track the impact of mitigation actions at the national level is in general less sophisticated than the system for emissions. The inter-ministerial CO₂ Working Group, formed in 1990, has a mandate to track emissions trends, report on the impact of mitigation actions, and issue recommendations to the government. However, methods to estimate and aggregate the mitigation outcomes of individual policies and measures are still developing. To date, UBA has issued only one report evaluating the IEKP (the national climate protection program established in 2007, now replaced by the Energiewende laws).

Tracking of individual mitigation actions, such as the German feed-in tariff for renewables, is comparatively better evolved, with clear responsibilities among agencies and the participation of

	EMISSIONS	MITIGATION ACTIONS
TRANSPARENCY	VERY TRANSPARENT	SOMEWHAT TRANSPARENT
COMPARABILITY	VERY COMPARABLE	SOMEWHAT COMPARABLE
RELIABILITY	VERY RELIABLE	FAIRLY RELIABLE
USEFULNESS	VERY USEFUL	FAIRLY USEFUL
TIMELINESS	VERY TIMELY	FAIRLY TIMELY
COMPLETENESS	VERY COMPLETE	FAIRLY COMPLETE

research institutions. The regular progress report on renewables policies describes the status of policy implementation and makes recommendations to the German parliament.

Detailed Assessment: Tracking Emissions

1) Transparency:

VERY TRANSPARENT

The German GHG inventory system is transparent: Methodologies for data collection, uncertainty analysis, quality control and quality assurance are clearly explained in the national inventory report. Changes to methods are also clearly explained, and historical results archived. Emissions estimates are published in common reporting format tables, and most underlying data sets—such as the energy balance, industry data, and data input for forestry sinks—are publicly accessible in spreadsheet format. UBA, the responsible agency for the GHG inventory, submits the inventory for expert review and conducts peer reviews for methodology development.

Data flows and responsibilities for data provision have been changing; for instance, iron and steel data were discontinued from the federal statistics and are directly provided by the industrial association as an ad-hoc replacement. Data

confidentiality issues limit public access to installation-specific data, and in some instances limit government access as well. However, policymakers are able to access aggregate industry data.

2) Comparability:

VERY COMPARABLE

Germany follows IPCC guidelines;¹² methods are consistent across years and sectors, and they are reported in CO₂-equivalent terms, allowing comparison and summation across gases. When data or methods are updated, UBA provides revised estimates of previous years' emissions and explains any changes. Germany has made considerable effort to harmonize pre-German-unification datasets.

3) Reliability:

VERY RELIABLE

The UBA collects activity data and estimates emissions with help of a data management system that automatically conducts quality checks. There is strong continuity in the UBA experts listed as authors in the National Inventory Report (NIR). The GHG inventory is reviewed by responsible ministries before it is sent to EEA and the UNFCCC. Third-party external reviews are carried out by UNFCCC reviewers (in-country and centralized) and the EEA.

¹² IPCC, 1996.

Methodologies are checked and revised every year during the annual compilation of the inventory. Where methodological challenges are identified, either through internal or external review processes, the UBA Working Group on Emissions Inventories organizes methodology workshops and informal reviews with other European Member States to learn from other countries' experiences. For some source categories there are survey quality problems with federal statistics, such as low feedback or a non-representative statistical boundary. This prompted the UBA to contract industry association data to improve data quality.

Emissions data from German installations covered by the EU ETS are used for verification and for quality assurance, but not directly to construct the inventory.¹³ The complete system for inventory development is regularly reviewed by an independent research institution.¹⁴

4) Usefulness:

VERY USEFUL

National inventory data are used as a basis for sectoral emissions projections in the National Communications, the Policy Scenarios and the Projection report required under the EU Monitoring Mechanism. The data are explicitly intended to inform the policymaking process. Emissions data are provided in a standardized format with the national inventory report and common reporting format tables. The latter (publicly available in spreadsheet format) provide trends over time of key emissions source categories. Graphical overviews and fact sheets are prepared at different degrees of technical detail by type of GHG and sector. The Länder (states) working group on energy balances provides additional public emissions and energy data at the Länder level.¹⁵

5) Timeliness:

VERY TIMELY

GHG inventory reports to the Ministry and UNFCCC are produced annually. Emissions data

¹³ EEA, 2011.

¹⁴ Herold, 2009.

¹⁵ Germany, 2011.

are available with a lag of less than 12 months. However, UNFCCC expert review teams have frequently commented on delays in the provision of accurate inventory data; this is because only preliminary energy balance data are available at the due date (end of July). As a result, emissions data are often recalculated and published in the subsequent year's National Inventory Report.¹⁶

6) Completeness:

VERY COMPLETE

The GHG inventory covers all sectors and sub-sectors and all relevant source categories. The inventory covers all six primary GHGs and four indirect GHGs (nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, and sulfur dioxide); gases are aggregated in CO₂-equivalent terms. The inventory covers all years since the base year of 1990, with complete geographical coverage of Germany. Emissions and energy data are also available at the Länder level.

Detailed Assessment: Tracking Mitigation Actions

1) Transparency:

SOMEWHAT TRANSPARENT

At the national level, the National Communication, the EU Monitoring Mechanism, and the report on the Integrated Energy and Climate Program (IEKP) all track the progress of Germany's climate protection measures.

The National Communication and EU Monitoring Mechanism report clearly describe the expected impact of mitigation actions, and associated methodologies and assumptions. The IEKP report provides estimates of the actual (past) impact of national mitigation actions. Methodologies for the IEKP report are still evolving, but the report clearly describes the assumptions behind its quantitative and qualitative findings, and also identifies some general sources of uncertainty.

Where actual (past) impacts are tracked for individual mitigation actions, the relevant regulations determine whether the data are publicly available. For example, for the German feed-in tariff,

¹⁶ UNFCCC, 2010.

data for renewables deployment are available by Länder, installation type and renewables type (e.g. wind, solar, biomass), methodologies are transparently documented and archived, and reports follow a clear timeline.

2) Comparability:

SOMEWHAT COMPARABLE

The absence of internationally accepted methods for quantifying emissions reductions for individual mitigation actions limits the comparability of emissions reductions and tracking in general. At the national level, only one report of actual (rather than projected) policy impacts has been produced; whether Germany establishes a more comparable set of performance measures under the new Energiewende laws will become evident over time.

Performance data for individual mitigation actions, such as support for renewables, use consistent and transparent methods and are more comparable over time. This reporting is supported by the establishment of the permanent Working Group on Renewable Energy Statistics (AGEE-Stat).

Germany's energy efficiency measures are included in the EU-wide Mure database,¹⁷ which aggregates reporting on energy efficiency program activities across the EU and aims to present information on program impacts in a comparable manner—for example, reporting the energy saved through each policy and categorizing each as high, medium, or low impact.

3) Reliability:

FAIRLY RELIABLE

Data on the feed-in tariff and renewables in general are increasingly reliable, while estimates of the impact of the IEKP mitigation actions are more uncertain as methodologies have not been fully defined. The UBA, responsible for the first IEKP report, draws its expertise from various internal (UBA, ministerial and agency) and external staff. Renewables in general are observed by the permanent working group AGEE-Stat, which ensures that data are maintained and reviewed by

¹⁷ ISIS, 2011.

the group continuously over time.

Currently, research projects and other studies commissioned by federal ministries aim to review and improve post-implementation evaluation methodologies. Research is also conducted at the European level.¹⁸

Third party review applies to the National Communication (in-depth reviews by UNFCCC experts) but not yet to other national tracking systems.

4) Usefulness:

FAIRLY USEFUL

At the national level, emissions projections such as those prepared for the National Communication and EU report have informed decisions on national climate programs such as the IEKP and Energiewende laws. Information on the impact of individual mitigation actions such as the feed-in tariff enters directly into the policy-making process (see case study on page 18), and progress reports on the implementation of renewables policies are used as the basis for legal reforms.

Policy cost-effectiveness is not systematically evaluated, but ad hoc studies are conducted for some individual measures. For example, the Ministry of Environment studied the cost-effectiveness of the feed-in tariff in 2007, and further studies were conducted on the tariff's impact on private household electricity prices and industry in 2011. The results of these studies are public.

5) Timeliness:

FAIRLY TIMELY

Germany's tracking systems operate on different timelines, according to international obligations, domestic mandates, and ad hoc processes. The National Communication is produced every 4–5 years, and the EU Monitoring Mechanism report every 2 years. Only one report on the impact of the 2007 IEKP has been produced; the tracking has now been replaced by the 2011 Energiewende laws. Monitoring practices for the new laws are under development through commissioned

¹⁸ Buttazoni et al., 2010.

research projects and tracking methods will be decided by the end of 2012.

The frequency of performance reports for individual mitigation actions varies. The feed-in tariff has regular interim reports and a more comprehensive assessment every four years. The working group AGEE-Stat produces annual reports on renewables.

6) Completeness:

FAIRLY COMPLETE

Germany's mitigation actions and tracking systems cover the entire country. The national

climate protection programs, such as the IEKP, focuses primarily on CO₂ emissions from the energy sector. The National Communication lists additional mitigation actions in the agriculture and industrial process source categories and incorporates all six Kyoto greenhouse gases in its projections of future emissions trends. In some instances, reporting on individual mitigation actions (e.g., the feed-in tariff) includes non-climate co-benefits such as employment. In general, indirect climate policies such as energy taxes or tax exemptions are not covered in national climate program reporting.

CASE STUDY: MRV AND PROGRAM DESIGN FOR GERMANY'S FEED-IN TARIFF

The German feed-in-tariff, part of the Renewable Energy Sources Act (EEG), supports eligible renewable technologies with a fixed payment per unit of electricity generated for a period of 20 years. The payment rate for new installations decreases over time to maintain cost-effectiveness. The main tracking tool for EEG measures is the EEG progress report,¹ in which the German government informs the German parliament and public about the effects, costs, and mitigation outcomes. The progress report is coordinated by the German Ministry of Environment (BMU) and based on commissioned research.

The 2007 progress report pointed out that electricity generation costs from solar photovoltaics (PV) had fallen substantially since the EEG commenced, and that further cost reductions of PV systems on the order of 7-10 percent per year were possible through 2010.² The progress report therefore recommended accelerating the reduction of the basic feed-in tariff. Parliament discussed these recommendations and adopted reforms less than one year after the publication of the progress report.

This example shows that the EEG progress report provides transparent and useful evidence for timely policy adjustments. This system will continue to track the EEG's impacts; over time it will provide feedback on the effectiveness of the reforms as well.

¹ BMU, 2007a.

² Ibid., p. 128.

Italy

Background and Reporting Activities

Italy's short-term economic concerns dominate the current political debate, overshadowing other issues. The most recent National Energy Plan dates from 1988, limiting the country from having a comprehensive and integrated long-term vision and effective strategic approach for tackling GHG emissions.

Nevertheless, the country has taken important steps with regards to climate change, mainly driven by international and EU obligations. As a party to the UNFCCC and the Kyoto Protocol and under the EU burden-sharing agreement, Italy is committed to reducing its GHG emissions by 6.5 percent by 2008--2012 relative to 1990 levels. In April 2012, the Ministry of Environment submitted a proposal for a new National Plan for the Reduction of GHG Emissions, which extends through 2020.¹⁹ The previous plan was approved in 2002. In accordance with EU directives, Italy adopted a national action plan on energy efficiency in 2007 (revised in 2011) and a national action plan on renewable energy in 2010. Among

the most important and successful measures are the EU ETS Directive (covering about 38 percent of Italian GHG emissions in 2010), the White Certificate Scheme for energy efficiency, and the Green Certificate Scheme for renewable energy.

As an EU Member State and Annex I party to the UNFCCC, Italy is committed to reporting on its GHG emissions and mitigation actions. Key MRV systems include the national GHG inventory (and related underlying statistics), submissions of National Communications to the UNFCCC and under the EU Monitoring Mechanism Decision, reporting activities under EU directives on renewable energy and energy efficiency, and tracking systems for individual policies. Italy's GHG emissions inventory was established in 1999 for compliance with UNFCCC obligations and is managed by the Institute of Environmental Protection and Research (ISPRA), the Ministry of Environment's public scientific and technical agency.

Tables 3.1 and 3.2 provide an overview of Italy's systems for tracking emissions and mitigation actions.

Table 3.1: Systems for Tracking Emissions

SYSTEM	GHG INVENTORY
MEASUREMENT	Six primary GHGs; use accepted international guidelines.
REPORTING	Annual; data online on UNFCCC and ISPRA websites. Underlying data available in statistical yearbooks published by ministries, national agencies and industry associations.
VERIFICATION	Quality assurance and control procedures; uncertainty analysis; UNFCCC expert review; verification of data with plant-specific emissions figures under various EU directives; internal review by sectoral working groups.

¹⁹ MATTM, 2012.

Table 3.2: Systems for Tracking Mitigation Actions

SYSTEM	NATIONAL COMMUNICATIONS	EU MONITORING MECHANISM	NATIONAL TRACKING OF ENERGY EFFICIENCY AND RENEWABLE ENERGY	INDIVIDUAL POLICY TRACKING SYSTEMS
MEASUREMENT	Description of policy, pre-implementation emissions reduction estimates.	Description of policy, pre-implementation emissions reduction estimates.	Energy efficiency: Description of progress towards targets, pre and post-implementation estimates of energy savings, pre-implementation estimates of GHG mitigation. Renewable energy: Description of progress towards targets, reporting on energy deployment.	Provisions are defined in individual policies; agencies provide mitigation estimates where possible.
REPORTING	Every 3-5 years; publicly available.	Every 2 years; publicly available.	Energy efficiency: Annual; additional reporting every 3-4 years when the energy efficiency plan is updated. Renewable energy: Annual.	Reporting schedule depending on requirements of specific legislation; provide progress reports on the implementation status of mitigation actions.
VERIFICATION	Expert review under UNFCCC.	EEA review of submitted data and information.	Internal verification by responsible national agencies.	Verification is usually carried out by official government agencies, using desk-based analysis and online spot checks. External verification of data occurs when mitigation actions fall under EU legislation.

Evaluation of Domestic MRV Systems

Overview

Italy’s GHG emissions inventory is very comprehensive and ensures reliability and comparability of results. Italy follows IPCC guidelines and regularly updates its methods and procedures in light of the results of internal assessments and international reviews. The inventory benefits from the strong technical expertise of ISPRA, and the authority and independence of the statistics institutions responsible for the underlying data used in the GHG emissions inventory.²⁰ Nevertheless,

20 Ministries, public agencies, and industrial associations are coordinated under the umbrella of the National Statistics System (Sistan).

national and international reviews have highlighted the need to increase capacity and resources; moreover, it is not clear to what extent GHG emissions calculations ultimately feed into the policymaking process.

Overall, Italy’s systems for tracking mitigation actions satisfy the six criteria to some extent. National reporting on mitigation actions is fairly complete and reliable, and includes robust entity-level reporting. Integration between tracking

The independence of the statistical information produced in Italy is guaranteed by the Commission for Guaranteeing Statistical Information (CoGIS), and quality of data is improved following suggestions of specialized technical working groups.

	EMISSIONS	MITIGATION ACTIONS
TRANSPARENCY	VERY TRANSPARENT	SOMEWHAT TRANSPARENT
COMPARABILITY	VERY COMPARABLE	SOMEWHAT COMPARABLE
RELIABILITY	FAIRLY RELIABLE	SOMEWHAT RELIABLE
USEFULNESS	FAIRLY USEFUL	FAIRLY USEFUL
TIMELINESS	VERY TIMELY	FAIRLY TIMELY
COMPLETENESS	VERY COMPLETE	FAIRLY COMPLETE

systems and policymaking is partially ensured by the cross-ministerial Technical Committee on Emissions (CTE). National reporting does not provide comprehensive information on the cost-effectiveness of mitigation actions or ex-post estimates of emissions impacts. Furthermore—unlike the GHG inventory—it does not apply established methods and procedures. However, in 2011 Italy started to provide aggregated post-implementation evaluations of energy savings (GWh/year) and cost-effectiveness (euro/kWh) of several policies in the framework of the national energy efficiency action plan, while reporting on the status of development of renewable energy (MW deployed) is ongoing since 2009.

National systems for MRV of individual mitigation actions appear to be reliable, but have limited comparability; they are driven by requirements laid down in legislation underpinning each policy, and are harmonized to international standards when explicitly required by supranational legislation (EU directives and regulations). They usually do not track progress in terms of GHG abatement.

Detailed Assessment: Tracking Emissions

1) Transparency:

VERY TRANSPARENT

The National Inventory Report (NIR) follows official IPCC guidelines, and UNFCCC expert

review of the inventory is carried out transparently. ISPRA applies and clearly describes the IPCC methods used for uncertainty estimation. The agency annually documents and archives emissions estimates, methodologies, and source category spreadsheets according to a National Quality Assurance/Quality Control (QA/QC) Procedures Manual published in 2006.²¹

Underlying data at the national level are available online and can be downloaded in spreadsheet or PDF format. Compilers of the energy balance apply internal procedures to ensure traceability of methodological changes.²² Procedures for data collection on electricity production and consumption are published online by the National Independent System Operator (TERNA).²³ However, the methods used in the national energy balance are not fully described.

Inventory data are used for three main publications: the NIR (a detailed, 400-page document); ISPRA's Annual Environmental Yearbook (contains national and sectoral emissions); and the Environmental Statistics section of the Italian Statistical Office (ISTAT) website (presents

²¹ APAT, 2006.

²² Ministry of Economic Development (MSE), personal communication, 2011.

²³ TERNA, personal communication, September 2011.

national emissions time series).²⁴

2) Comparability:

VERY COMPARABLE

ISPRA applies IPCC guidelines and implements expert recommendations to ensure consistency and comparability of calculation and reporting methods over time. Recalculations are applied to the entire time series from 1990, and changes to previous estimates are described in the sectoral chapters and the Common Reporting Format tables. The Ministry of Economic Development cooperates with Eurostat and IEA to ensure consistency of methodological changes for the national energy balance. Methodological changes, in turn, are applied to historical series when sufficient resources are available.²⁵

3) Reliability:

FAIRLY RELIABLE

Italy follows international guidelines in preparing its inventory. ISPRA is an institution with strong expertise on GHG reporting built up over more than 10 years. The agency uses advanced IPCC methods to estimate emissions from most sectors, and independently verified entity-level data from EU-wide GHG and air pollution information systems are used where possible. Periodic audits in the context of fiscal checks may also help indirectly to prevent misreporting by installation-level providers.²⁶

The Ministry of Economic Development applies international procedures, such as Eurostat/IEA guidelines, for the preparation of the national energy balance.²⁷ However, procedures regarding underlying data collection are not always clear or disclosed. Emissions figures are reviewed by industrial associations, local authorities, and expert task forces within the context of quality assurance and control activities,²⁸ and by the UNFCCC after submission of the National Inventory Report. The inventory system itself is not independently reviewed due to a lack of

²⁴ ISPRA, personal communication, September 2011.

²⁵ MSE, personal communication, 2011.

²⁶ Ibid.

²⁷ Ibid.

²⁸ ISPRA, 2009.

resources in the government statistical agencies.²⁹

ISPRA collaborates with various data providers and research institutes to improve data estimates. Reviews and other measures help ensure the independence of the National Statistics System (Sistan) and improve the quality of national statistics.³⁰

4) Usefulness:

FAIRLY USEFUL

Inventory data support national policy development to some extent: CTE uses trends derived from the inventory in its work, and emissions data were an important input to the policy process when Italy financed the Italian Carbon Fund established at the World Bank.³¹ However, Italy still lacks a comprehensive national energy strategy that integrates its climate change mitigation objectives, and the substantive policy role of cross-ministerial bodies such as CTE is not clear.

5) Timeliness:

VERY TIMELY

GHG reporting has a two-year time lag; however, Italy also prepares a proxy GHG inventory with a one-year lag. Data collection and reporting for the national inventory occur annually; the national energy balance receives monthly data from industrial entities and publishes this data annually in summary reports.

6) Completeness:

VERY COMPLETE

The inventory includes all six direct GHGs covered under the Kyoto Protocol, as well as four indirect GHGs (nitrogen oxides, carbon monoxide, non-methane volatile organic compounds, and sulfur dioxide). All major sources and sinks are covered for the years between 1990 and 2009, and the inventory is complete in terms of geographical coverage.

A national registry for carbon sinks is under development; a national land use inventory has recently been completed and aims to improve

²⁹ Eurostat, 2006; CoGIS, 2010; MSE, personal communication, 2011.

³⁰ ISPRA, 2011; CoGIS, personal communication, September 2011.

³¹ ISPRA, personal communication, September 2011.

inventory estimates.

Detailed Assessment: Tracking Mitigation Actions

1) Transparency:

SOMEWHAT TRANSPARENT

The National Communications and EU Monitoring Mechanism reports are Italy's main vehicles for comprehensive national reporting on mitigation actions and their impact on emissions. The reports provide a limited description of how emission projections are developed,³² but do not include the underlying data or assumptions used to estimate the impact of individual mitigation actions. Reports on renewable energy and energy efficiency measures provide a detailed description of the policies implemented and report on progress toward policy targets, along with a description of the methodologies used for mitigation estimates.³³ Individual mitigation actions generally require regulated entities to report and, in most cases, require competent authorities (agencies and ministerial offices) to prepare and publish updates on their implementation status. However, reports on renewable energy and energy efficiency, as well as progress reports for individual mitigation actions, usually do not include estimates of the emission reductions achieved. There is no publicly available formal record-keeping procedure for estimates of the impact of mitigation actions, either for national reporting or for individual mitigation actions.

Transparency of review processes vary. The Italian National Communication is subject to transparent external review by UNFCCC review teams. Results of EEA reviews of Italy's submissions to the EU Monitoring Mechanism are not publicly available;³⁰ nor are results from CTE's assessments of mitigation actions.

Uncertainty analysis is applied to national GHG emissions projections in the National Communication³¹ and to EU ETS price volatility within the EU Monitoring Mechanism,³² and to

³² UNFCCC, 2011.

³³ ENEA, 2011; Italy, 2012; GSE, 2011.

a limited extent to MRV of individual mitigation actions.

2) Comparability:

SOMEWHAT COMPARABLE

At an aggregate level, Italy tracks the impact of its mitigation efforts in its National Communication. Methods to project GHG emissions have been broadly consistent for the last two National Communications and conform to UNFCCC reporting guidelines.³⁴ Consolidated reports on energy efficiency and renewable energy use consistent methodology to report the impact of individual mitigation actions. Estimates of the impact of energy efficiency programs can be added or compared. Estimates included in the renewable energy and energy efficiency reports are harmonized to an EU methodological framework to ensure comparability across member states.³⁵

Methodologies applied to individual mitigation actions are less consistent since there is no international guidance available for calculating the impacts of mitigation actions. Methods for calculating program performance are defined within the relevant national or EU legislation, which can change over time, and methods usually do not cover GHG savings.³⁶

Italy's energy efficiency measures are included in the EU-wide Mure database, which aggregates reporting on energy efficiency program activities across the EU and aims to report program impacts in a comparable manner.

3) Reliability:

SOMEWHAT RELIABLE

Italy's sophisticated emission and economic modeling capacity delivers robust projections of future national GHG emissions for energy and other

³⁴ UNFCCC, 2011.

³⁵ European Parliament and the Council, 2006; European Parliament and the Council, 2009.

³⁶ For example, Directive 31/2010/EC (Energy Performance of Buildings Directive), revising Directive 2002/91/EC, requires that Member States adopt calculation methodologies of the energy performance of buildings that conform to the general framework provided by the Directive.

sectors.³⁷ National Communications are reviewed by international experts under the UNFCCC; this tends to focus on Italy's implementation of its reporting obligations under the Convention rather than the methods used for the projections. The external review team does not necessarily assess the quality of methods or provide advice on how to improve the quality and accuracy of data and methodologies.

There appear to be no standardized methods, guidelines, coordination mechanisms, or tools in place for the post-implementation or pre-implementation estimation of the impact of mitigation actions within National Communications and the EU Monitoring Mechanism. Methods typically rely on experts' knowledge within responsible institutions.

Monitoring and evaluation of individual policies in the energy and industry sectors have improved strongly in recent years, due to central government involvement.³⁸ External verification of the measurement and reporting of mitigation actions takes place to a limited extent, and third-party verification or certification occurs where required by EU regulation. The EU ETS—Italy's most important mitigation action—has advanced MRV requirements agreed to by the European Commission, following technical expert and public consultation.

4) Usefulness:

FAIRLY USEFUL

The CTE monitors and evaluates the status of mitigation actions and reports to the Inter-Ministerial Committee for Economic Planning. Its efforts have been criticized in the past for lack of effectiveness, and it is working to improve its performance.³⁹ Senior policymakers have also commented that the scarcity of cost-effectiveness data limits their ability to assess the policy portfolio.

Information on mitigation actions is available at multiple levels of detail within national reporting:

³⁷ ISPRA, personal communication, September 2011; MATTM, 2009.

³⁸ ISPRA, personal communication, May 2011.

³⁹ Corte Dei Conti, 2009.

highly technical data are produced for the UNFCCC, a shorter report is produced within the EU Monitoring mechanism, and aggregated levels of information are available through EEA summary tables.

Data and progress reports on the implementation of individual mitigation actions are often used in quantitative analysis and research for institutional, academic, and consulting purposes, at the sectoral and local levels.

5) Timeliness:

FAIRLY TIMELY

Data collection occurs yearly for EU ETS, Green Certificates, and White Certificates projects. For other mitigation actions, the timeline for data collection varies.

National reporting occurs through the National Communications every 3–5 years and through the EU Monitoring Mechanism every two years. Reporting activities on renewable energy and energy efficiency under EU directives 2009/28/EC (renewable energy) and 2006/32/EC (energy efficiency) are carried on a yearly basis. For some individual mitigation actions, progress reports are also prepared annually within the government.

6) Completeness:

FAIRLY COMPLETE

Evaluation of mitigation actions within the National Communications and the EU Monitoring Mechanism covers all climate-relevant sectors except for bunker fuels and international air transport, and cover all six Kyoto GHGs. Reporting on individual mitigation actions usually focuses on the regulated activity and does not include a direct estimate of GHG emission reductions.

Projections presented in the most recent National Communication and EU Monitoring Mechanism report cover the years 2010, 2015, and 2020.⁴⁰ Estimates of the overall GHG impact of planned policies and measures are only given for the years 2010 and 2020, even though UNFCCC guidelines suggest also reporting estimates for the years

⁴⁰ Italy, 2011.

2005 and 2015.⁴¹ Estimates in the renewable energy report only cover the year of reporting and the previous year.⁴² The energy efficiency annual report includes all main energy efficiency measures.⁴³

MRV systems for mitigation actions have complete geographical coverage; however, information is not broken down to the sub-national level.⁴⁴

CASE STUDY: MRV SYSTEMS WITHIN THE EUROPEAN UNION EMISSIONS TRADING SYSTEM

MRV activities in the EU ETS have improved ETS effectiveness by contributing to the review of the overall emissions cap and the adoption of centralized and harmonized allocation rules for emissions permits across EU Member States.

During the trial phase of EU ETS, between 2005 and 2007, the overall EU-wide cap was decentralized and determined “bottom-up” from individual Member States’ national allocation plans. These plans were based on pre-implementation emissions projections and varied widely among individual Member States with different levels of ambition and strategies for reducing emissions.¹

After the publication of the first emissions monitoring data—which were available only four months after the end of the reporting period—it was clear that there was an over-supply of permits in most of the countries. There were 4 percent more allowances allocated across the EU than there were emissions in 2005; and still 1 percent more allowances than emissions in 2007. This over-supply (reflecting both abatement and over-allocation),² combined with a ban for banking into the second phase of emissions trading, caused the price of carbon in the EU ETS to plummet: from €30 to €10 per tonne in April 2006 after 2005 emissions data were released, ending with a further drop to below €1 following publication of 2006 emissions data.

The European Commission incorporated early experiences and lessons gained during the pilot phase, and in October 2007 undertook more stringent review of the national allocation plans submitted for Phase II of the EU ETS (2008–2012), and revised allocations downward.³ Subsequently, some member states pointed out the need for simplification and harmonization of the allocation processes and related MRV, with several advocating for an EU-wide cap.⁴

The result was a new and centralized allocation methodology for the post Kyoto phase (2013–2020), with a more stringent cap and emissions permits allocated by sector rather than by Member State. The new allocation methodology involved additional MRV requirements, including new harmonized rules on benchmarks and a centralized data collection and verification process.

¹ Goers, 2010; Anderson and Di Maria, 2011.

² For a detailed discussion of this issue, see Ellerman and Buchner, 2008.

³ Europa Press Releases RAPID, 2007.

⁴ EEA, 2008.

⁴¹ UNFCCC, 2011.

⁴² GSE, 2011.

⁴³ ENEA, 2011.

⁴⁴ UNFCCC, 2011.

United States

Background and Reporting Activities

In 2009, President Barack Obama set a goal of reducing United States emissions in the range of 17 percent below 2005 levels by 2020. This target has not been formalized through binding domestic legislation; however, the Obama administration continues to pursue a range of national mitigation measures, including new regulations on power plant emissions, vehicle tailpipe standards, and clean energy and efficiency measures initiated through the American Recovery and Reinvestment Act of 2009. Many states have also set targets and implemented policies to reduce their emissions.

The United States has international reporting obligations as an Annex I party to the UNFCCC. The United States has a well-established inventory program for tracking its GHG emissions⁴⁵ and a new program for reporting facility-level GHG emissions;⁴⁶ both programs are implemented by the Environmental Protection Agency (EPA). The primary system for reporting on mitigation actions and their impacts is the National Communication to the UNFCCC.⁴⁷ There is also a broad range of MRV systems for individual mitigation actions, administered by the implementing agencies, and general oversight mechanisms at the federal level cover the processes for collecting

45 EPA, 2012a.

46 Facility-level data is reported on EPA's GHG Data website: <http://ghgdata.epa.gov/ghgp/main.do>

47 U.S. Department of State, 2010.

Table 4.1: Systems for Tracking Emissions

SYSTEM	GHG INVENTORY	GHG REPORTING RULE
MEASUREMENT	Six primary GHGs, using accepted international guidelines (generally with more detailed methods)	Six primary GHGs, using EPA methods.
REPORTING	Annual; data online on agency websites.	Annual, beginning with 2010 data (reported in 2011 and published in early 2012). Online.
VERIFICATION	External expert review; quality assurance and control processes; uncertainty analysis; cross-checking data sets; UNFCCC review	EPA verifies data submitted by reporting entities.

Table 4.2: Systems for Tracking Mitigation Actions

SYSTEM	NATIONAL COMMUNICATIONS	INDIVIDUAL POLICY TRACKING SYSTEMS	FEDERAL OVERSIGHT MECHANISMS
MEASUREMENT	Agencies provide mitigation estimates if possible, for six primary GHGs. No common definition of mitigation action or common process for measuring outcomes.	Policy outcomes (sometimes including emissions impact); spending	Policy outcomes; spending
REPORTING	Every 4-5 years; publicly available	Generally annual; publicly available	Varies: some annual Office of Management and Budget (OMB) reports, budget requests, reports by the Government Accountability Office (GAO)
VERIFICATION	OMB review; verification of program outcomes by agencies.	Verification procedures such as sampling, testing, and auditing generally exist at policy level.	GAO evaluates programs at Congress's request.

and using performance data on all policies including mitigation actions.

Tables 4.1 and 4.2 provide an overview of U.S. systems for tracking emissions and mitigation actions.

Evaluation of Domestic MRV Systems

Overview

The United States' systems to measure, report, and verify its emissions are very strong: they are able to inform future policymaking as well as domestic and international stakeholders. The well-developed GHG inventory program demonstrates all of the attributes needed to meet these core policy objectives: It is transparent, comparable, reliable, useful, timely, and complete. The new GHG reporting program strengthens existing systems by providing more detailed emissions information. The United States' robust MRV systems for emissions also help track the aggregate effectiveness of U.S. action relative to its national emissions target; its usefulness in this regard will increase as more facility data become available.

In contrast, the United States' MRV systems for its mitigation actions are less effective. The United States has no regular process for tracking the impact of its policy portfolio related to climate change mitigation and assessing whether those measures are putting it on track to meet its stated emissions reduction target (beyond the inventory's aggregate assessment). Comprehensive analysis of mitigation actions is undertaken only to meet international obligations, at intervals of several years.

Methods for estimating the impact of mitigation actions are less transparent and generally less reliable than methods for estimating emissions. Mitigation outcomes are estimated in inconsistent

ways for policies across agencies and sectors, making it difficult to estimate the aggregate impact of these policies or compare the impact of different measures.

At the level of individual policies, there are some well-developed systems to track compliance and gather program data, and general oversight mechanisms help ensure the quality of policy-specific MRV systems. However, the manner in which these program data are converted to mitigation estimates is inconsistent and often unclear, and cost-effectiveness analysis is not consistently available.

Detailed Assessment: Tracking Emissions

1) Transparency:

VERY TRANSPARENT

The GHG inventory is a very transparent system: Most data included in the inventory are publicly available for free on federal agency websites,⁴⁸ and EPA provides detailed descriptions of its methodology, uncertainty analysis, and quality assurance procedures. EPA also submits the inventory for expert review, although this process is not public.

	EMISSIONS	MITIGATION ACTIONS
TRANSPARENCY	VERY TRANSPARENT	SOMEWHAT TRANSPARENT
COMPARABILITY	VERY COMPARABLE	NOT VERY COMPARABLE
RELIABILITY	VERY RELIABLE	SOMEWHAT RELIABLE
USEFULNESS	VERY USEFUL	SOMEWHAT USEFUL
TIMELINESS	VERY TIMELY	FAIRLY TIMELY
COMPLETENESS	VERY COMPLETE	FAIRLY COMPLETE

48 For example: energy data from EIA, http://www.eia.gov/environment/emissions/ghg_report/; agriculture data from USDA, http://www.usda.gov/oce/global_change/gg_inventory.htm; forest carbon data from the U.S. Forest Service, <http://www.fs.fed.us/rmrs/forest-carbon/>.

For the new entity-level GHG reporting program, facility emissions data can be viewed through a user-friendly online portal or downloaded in spreadsheet format. EPA verifies the data submitted by entities reporting their emissions, but there is no third-party audit or independent expert review process. Reporting entities are not required to identify or measure sources of uncertainty in their emissions reports; EPA has not stated if it will conduct uncertainty analysis.

2) Comparability:

VERY COMPARABLE

The methodology for the GHG inventory follows international (IPCC) guidelines; methods are consistent across years and sectors, and they are reported in CO₂-equivalent terms, allowing comparison and summation across gases. When data or methods are updated, EPA provides revised estimates of previous years' emissions, with an explanation of any changes. Likewise, the reporting rules under the new GHG reporting program appear to be effectively designed to produce data that are consistent across sectors and can be compared to data from other countries. It is not clear how the reporting program and inventory will interface with each other.

3) Reliability:

VERY RELIABLE

Most data in the GHG inventory come from agencies that have a great deal of expertise and experience collecting relevant sectoral data; their data are widely relied upon by industry and other stakeholders. EPA has already produced 15 full inventories as of 2011 and, in the process, has developed significant staff expertise and capacity, including in-house quality control and uncertainty analysts. Data in the inventory are subject to formal expert review, and EPA also consults third-party experts during development of the inventory. EPA continually revises and improves the methodology used in the inventory, and program staff members regularly work with the IPCC and UNFCCC to improve methodologies.

The methodologies used in the GHG reporting program are based on those used to prepare the inventory and are thus equally sophisticated.

The reporting program is not subject to external review, but the program's design reflects IPCC best-practice guidelines. There are penalties for failing to report, and as reported data are not used for enforcement of any current regulations, there is little incentive for reporting entities to falsify data.

With the combination of the inventory and reporting rule, the United States is now preparing both bottom-up and top-down estimates of emissions. Although the reporting rule does not cover 100 percent of U.S. emissions, EPA has indicated that data collected through the reporting program will be used to improve the accuracy of the inventory.⁴⁹

4) Usefulness:

VERY USEFUL

Policymakers have historically relied on EPA and Energy Information Administration (EIA) data and analysis; EIA's analyses and data are particularly well-incorporated into policymaking related to energy. EPA provides reports at varying levels of detail when it publishes the GHG inventory, from fact sheets summarizing key points to comprehensive reports with full technical details. The inventory and facility-level data both break down emissions trends and levels in various ways of use to policymakers, including by end-use sector and by gas. Data collected through the facility reporting program can be viewed by industry and by type of gas. The GHG reporting program explicitly aims to inform policy.⁵⁰

The GHG inventory does not break down emissions data below the national level, although EIA provides detailed energy data at the state and regional level and recently began reporting energy-related GHG emissions by state, and EPA provides guidance and data tools to help states construct their own inventories. Data collected through the reporting program are viewable on a map showing the location of individual facilities, and can be aggregated at the state and county level.

⁴⁹ EPA, 2012b.

⁵⁰ EPA, 2012c.

5) Timeliness:

VERY TIMELY

GHG inventory reports are produced annually, typically with a two-year lag in data (for example, the 2011 inventory covered the years 1990–2009). Data collection by agencies occurs on set schedules, though collection intervals vary from weekly to once every several years. The GHG reporting program will collect and publish data annually, with a similar lag; reporting entities were required to submit data on 2010 emissions in late 2011, and EPA published the data in January 2012.

6) Completeness:

VERY COMPLETE

The GHG inventory covers all sectors and sub-sectors and all relevant source categories, with additional information on “key” sources that contribute significantly to emissions or sequestration; sources in this category account for 98–99 percent of emissions. Both the inventory and the GHG reporting program cover the six primary GHGs and the entire United States. The inventory covers all years since 1990; data from the reporting program will also be available for each year from 2010 on. The inventory report also includes extensive information on methodology and uncertainty analysis.

The GHG reporting program covers facilities with annual emissions of 25,000 tCO₂e or more. It includes power plants, most industrial facilities, landfills, and suppliers of fossil fuels and industrial GHGs, but does not cover emissions from agricultural sources, land use, or sinks. The first set of data on facility-level emissions includes approximately 6,200 facilities representing 55 percent of U.S. emissions in 2010. In total, the reporting program covers approximately 80 percent of U.S. emissions, including both direct emitters and suppliers.⁵¹

Detailed Assessment: Tracking Mitigation Actions

1) Transparency:

SOMEWHAT TRANSPARENT

Information on mitigation actions—including

51 EPA, 2012b.

the implementing agency, program design, and expenditures—is readily available to the public, but information on the outcomes of mitigation actions is less complete. Agencies often publish data on compliance with a policy, or on a policy’s progress toward specific goals, but this often does not include data on associated emissions reductions. The largest gap in transparency occurs where program data is translated to mitigation estimates: EPA’s reports to Congress do not always identify the data used to estimate mitigation, and the National Communication does not clearly identify the data and methods used to estimate mitigation. The Office of Management and Budget (OMB) publishes an annual account of federal climate-change-related expenditures, but this report does not track policy outcomes.⁵²

Most MRV systems for mitigation actions do not include independent expert review; OMB conducts an internal review of the National Communications, but the results are not reported publicly or to external parties. Most MRV systems for mitigation actions do not identify sources of uncertainty.

2) Comparability:

NOT VERY COMPARABLE

Mitigation actions are tracked individually by their implementing agencies, according to the rules established in each policy. Methods for estimating the impact of mitigation actions vary across agencies and, in some cases, within agencies; as a result, estimates cannot be systematically compared or aggregated to the sectoral or national level. However, many significant mitigation actions in the United States are implemented by EPA, which reports mitigation impacts of most of its programs in consolidated reports with comparable data;⁵³ emissions impacts reported by EPA can be summed and compared across programs.

Most mitigation estimates are reported in standard, internationally accepted units (e.g., tCO₂e).

52 OMB, 2010.

53 Emissions avoided through some EPA programs—including Energy Star energy efficiency programs, CH₄ initiatives, and voluntary partnerships to reduce emissions of fluorinated gases—are reported in annual reports, accessible at <http://www.energystar.gov/>.

However, the lack of international standards for calculating impacts of mitigation actions means that estimates of policy impacts in the United States are not necessarily comparable to those of other countries.

3) Reliability:

SOMEWHAT RELIABLE

Given the lack of public information about methodology, it is difficult to judge the reliability of estimates of mitigation outcomes. The reliability of data sources and methods varies significantly. Mitigation estimates in the National Communication are reviewed by OMB; third-party review of mitigation estimates is otherwise limited. The Government Accountability Office (GAO) reviews programs on an ad hoc basis, at the request of the U.S. Congress.

Some large-scale, mandatory programs use well-established MRV systems to track compliance. For example, for vehicle tailpipe standards, EPA requires regular emissions testing by manufacturers and independently verifies test results, building on compliance procedures already in place for vehicle fuel economy standards.⁵⁴ However, some of the actions for which mitigation claims are made in the National Communication are voluntary programs and partnerships. Data on the impact of these programs are generally less reliable; in some cases, compliance data are self-reported and do not require verification, and sources may have an incentive to falsify data (see case study on page 31).

EPA's new GHG reporting program could play a useful role in gauging the effectiveness of mitigation actions. The program is designed to generate reliable emissions data at a finer level of detail than that provided by the GHG inventory. This will help provide a sense of the overall effectiveness of U.S. policy efforts, although it will not be sufficient to assess individual policies.

4) Usefulness:

SOMEWHAT USEFUL

Agency data on program performance, OMB's reports to Congress, and GAO reports all

⁵⁴EPA, 2010.

influence the policymaking process. However, data on the impact of mitigation actions are not always available in a form that is useful to policymakers pursuing climate-related goals. In many cases, it is impossible to compare programs to each other with respect to their mitigation impact or cost-effectiveness. There is a particular lack of policy-relevant outcome data for research and development (R&D) programs, where expenditure data are available but outcomes are not consistently reported.

The National Communication provides a high-level, non-technical overview of current mitigation efforts and their outcomes, but because mitigation estimates are not calculated with consistent methodologies, it does not provide the basis for robust comparison of different programs. OMB's reports to Congress provide information on climate-related expenditures, not outcomes, and GAO's reports are sporadic. At the level of individual policies, agency reports tend to be highly technical and focus on program-specific outcomes rather than the resulting GHG mitigation. The GHG inventory and sector-specific data do provide useful information on trends in emissions, and the new GHG reporting system could also prove to be a useful tool for policymakers.

5) Timeliness:

FAIRLY TIMELY

Budget and performance data are collected annually for most mitigation policies, although this does not always include data on mitigation impact. For many mitigation actions, the National Communication, produced every 4-5 years, is the only regular vehicle for reporting of mitigation efforts and impact. EPA's budget reports provide annual information on mitigation impact for some policies, and OMB provides expenditure information annually.

6) Completeness:

FAIRLY COMPLETE

Most of the actions for which the United States reports mitigation estimates in its National Communication have some form of MRV process. The National Communication has tracked the portfolio of U.S. mitigation actions since the

mid-1990s, covering policies across all major sectors and all gases affected by mitigation actions. However, mitigation estimates are not available for many programs in the transportation and forestry sectors, as well as for most inter-agency or cross-cutting programs.

MRV systems are better developed for programs

that directly influence current emissions; outcome measures are less clear for R&D programs and other efforts to influence innovation and future emissions. The National Communication gives mitigation estimates for some R&D programs; for its R&D programs, DOE more commonly reports metrics such as the number of technologies commercialized and patents obtained.⁵⁵

CASE STUDY: MRV FOR THE UNITED STATES' ENERGY STAR PRODUCT LABELING PROGRAM

The Energy Star product labeling program is a voluntary certification program to promote sales of energy-efficient appliances. It is run by EPA and the U.S. Department of Energy (DOE), and allows manufacturers to advertise certified appliances with the “Energy Star” label. In its reporting to the UNFCCC, the United States estimates that the program avoided 82.5 MtCO₂e of GHG emissions in 2010. Recent program reviews provide an example of two MRV systems in action: EPA and DOE’s internal process for tracking the impact of the product labeling program on energy usage and GHG emissions, and GAO and the agency inspectors general’s independent review powers.

Until 2010, virtually all Energy Star labels were granted based solely on self-certification by manufacturers; EPA and DOE did not test products themselves and did not require third-party testing to verify the energy usage data submitted by manufacturers. Independent review processes—including a widely publicized investigation by GAO, as well as reports by EPA’s Inspector General—exposed that the MRV system for the program was unreliable and vulnerable to abuse.¹ Without an effective verification system, the Energy Star program was not meeting its goal of providing a useful signal to customers and promoting purchases of energy-efficient products. In addition, without good compliance data, the agencies could not accurately determine whether the program was effectively reducing energy use and GHG emissions.

In response, EPA and DOE significantly improved their procedures, including requiring independent testing of products.² These changes will allow the program to more effectively fulfill its purpose as a driver of energy efficiency; it will also produce more reliable estimates of the program’s impact on GHG emissions. The agencies have also made changes to the program intended to boost its impact on energy efficiency, based on insights from the independent reviews.³ The independent reviews have thus served as an effective MRV system, providing agencies and the public with transparent and useful information on the program’s progress toward its stated objectives.

This example also illustrates the importance of publishing negative as well as positive information. Although the GAO report cast the Energy Star program in a negative light, its publication ultimately helped the responsible agencies craft better policy.

¹ GAO, 2010; EPA IG, 2009.

² GAO, 2011.

³ GAO, 2011.

⁵⁵ For example, see DOE, 2012.

Conclusions

The four countries studied in this report have different domestic policy priorities and different international commitments; accordingly, they employ varied systems to track emissions and mitigation actions. However, all four countries have stated goals of reducing the level and/or intensity of GHG emissions, and all are engaging in significant mitigation actions across multiple sectors. Accordingly, they can all benefit from effective MRV systems that clearly track emissions and policy effectiveness.

Key Findings

EXISTING MRV SYSTEMS ALLOW COUNTRIES TO DETERMINE IF THEY ARE MEETING EMISSIONS REDUCTION TARGETS, BUT DO NOT ALLOW THEM TO IDENTIFY THE MOST EFFECTIVE AND RESOURCE-EFFICIENT POLICIES. Ideally, MRV systems would allow policymakers to determine which policies are contributing most effectively to climate mitigation goals, and to measure whether policies are achieving their goals cost-effectively. There are major obstacles to achieving this level of performance. It is very difficult to attribute precise outcomes and costs to policies in a constantly changing world; it is also difficult to assess the performance and cost-effectiveness of policies with multiple objectives. However, policymakers must decide how to allocate limited public resources with or without this information; improving MRV on this front would be difficult but very beneficial.

ACROSS THE BOARD, SYSTEMS TRACKING EMISSIONS ARE MORE TRANSPARENT AND COMPARABLE THAN SYSTEMS TRACKING MITIGATION ACTIONS. Tracking GHG emissions has a clear meaning and purpose across varied domestic policy environments, and in developing and implementing systems to track emissions, countries can draw on existing best practices such as those developed by the IPCC. The greater consistency in MRV of emissions is due in part to the role of the UNFCCC; countries' systems for tracking emissions have been developed in the context of an international framework.

There are fewer existing best practices for countries to draw on when tracking the impact

of mitigation actions. Estimating the impact of mitigation actions is inherently more difficult than estimating current emissions levels, although some common guidelines are emerging.⁵⁶ It is not always clear what would have happened in the absence of a particular policy, and when policies overlap, it is difficult to determine how much of an observed reduction in emissions should be attributed to each. All four countries examined in this report are struggling with these challenges, and all four countries—as well as the international community—would benefit from more robust and comparable methods to track mitigation actions.

TRACKING SYSTEMS ARE STRONGER FOR MITIGATION ACTIONS THAT RELATE TO INTERNATIONAL POLICIES OR MAJOR, MANDATORY DOMESTIC POLICIES.

There are relatively strong MRV requirements for emissions reporting under the UNFCCC, as well as for mitigation actions that connect to European Union requirements. For domestic activities, countries also place a greater emphasis on reliability of data for policies that are mandatory and large-scale. Tracking systems are notably weaker for domestic policies that are voluntary or do not involve significant expenditures of public funds; as a result, estimates of the impact of these programs are less available and less reliable. While this may reflect a reasonable allocation of limited MRV capabilities and resources, it means countries are not well placed to take a comprehensive look at the effectiveness and efficiency of their climate actions.⁵⁷

SOME TRACKING SYSTEMS ARE LEADING—NOT JUST FOLLOWING—THE SETTING OF POLICY TARGETS.

Beyond simply tracking progress toward fixed targets, some tracking systems can inform policy design and the selection of targets. As demonstrated by some systems described in this study, tracking systems are well-equipped to serve this role when they involve an impartial review process, present information in a timely manner, and have a strong institutional connection to the policy development process. A strong, dynamic MRV system can allow policymakers to

⁵⁶ For further discussion, see Ellis and Moarif, 2009.

⁵⁷ For more on the importance of comparability in facilitating international cooperation, see Levin and Bradley, 2010.

continually readjust to find the most efficient and effective policies and make the best use of available resources.

SYSTEMS TRACK POLICY OUTCOMES, BUT NOT NECESSARILY EMISSIONS OUTCOMES: Many mitigation actions are designed with goals other than or in addition to climate mitigation—such as expanding renewable energy capacity, weatherizing homes, or developing local economies. Still, countries consider these actions an important part of their portfolio of “climate measures.” For these policies, tracking systems often focus on outcomes other than emissions; these performance data are not consistently translated to mitigation estimates. While these systems may be adequately serving discrete policy-specific purposes, they do not facilitate a broader assessment of the policy’s effectiveness, nor of the broader climate policy portfolio’s effectiveness.

A COMPREHENSIVE VIEW OF COST-EFFECTIVENESS IS LACKING. There are few comprehensive efforts to measure whether policies are achieving their goals in a cost-effective manner. Assessing the cost-effectiveness of policies is often difficult. Nevertheless, in a context of limited government resources, it would help policymakers reduce the cost of achieving any given policy goal, or allow them to pursue more ambitious goals with the available resources.

MRV SYSTEMS ARE LESS COMPREHENSIVE FOR MITIGATION ACTIONS RELATED TO NON-ENERGY SECTORS (PARTICULARLY FORESTRY) THAN FOR ENERGY-RELATED POLICIES. Energy accounts for the lion’s share of emissions in all four countries in our study and is also the focus of most mitigation actions. However, if tracking of emissions and mitigation actions is less comprehensive for other sectors, policymakers and outside observers cannot see a comprehensive picture of emissions, mitigation opportunities, and performance of mitigation actions.

Good Practices and Gaps

The following specific good practices and gaps emerge from our analysis. These are particular characteristics of MRV systems that, in the

experience of one or more countries in our study, seem to contribute significantly to their ability to effectively track emissions and mitigation actions.

Systems to Track Emissions

GOOD PRACTICES

- In the United States, facility-level emissions data are presented in a particularly user-friendly online format and at multiple levels of detail, including by sector, gas, type of facility, and location. The European Environment Agency has a similarly transparent online data viewer for European GHG inventories.⁵⁸
- The United States, Germany, and Italy all publish inventory data in the form of spreadsheets or a searchable database, allowing for further analysis by outside parties.
- In Germany, Italy, and the United States, regular improvements are made to the methodology for measuring emissions, and when estimation methods are updated, the new methods are applied to previous years to allow for comparability, with a clear explanation of any changes.
- In China, entities preparing emissions inventories have adapted international methods to national circumstances; for example, by developing new processes to collect data from sectors where prior data collection was irregular or unreliable.
- Germany and Italy use emissions data from facilities covered by the EU ETS to cross-check data collected for their GHG inventory.
- In Germany, Italy, and China, emissions trends and levels are broken down at the level of sub-national governments, to facilitate policymaking at multiple levels of government.

GAPS

- Data sources and methodologies are not always publicly available; this is a

⁵⁸ The data viewer is on EEA’s website: <http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer>.

particular issue in China.

- Funding for agencies with responsibility for data collection and analysis is sometimes limited, potentially reducing organizational flexibility and limiting the scope of MRV activities (for example, in Italy).

Systems to Track Mitigation Actions

GOOD PRACTICES

- China publishes comprehensive progress reports on mitigation actions, providing regular public updates on policies and their outcomes in a format that allows for aggregation and comparison of emissions reductions attributed to different policies.
- In its reporting on energy and climate actions, Germany publishes the results of pre-implementation modeling of policy impacts, describing methodologies and potential sources of uncertainty in detail.
- Through government oversight bodies, including the GAO, the United States publishes balanced assessments of mitigation actions that include negative as well as positive information, providing an unbiased look at policy performance and allowing for programs to be improved (see case study on page 31).
- Italy has begun providing post-implementation evaluations of energy savings and cost-effectiveness of its energy efficiency policies, within the framework of its national energy efficiency action plan.
- Germany convenes working groups, including outside experts, to evaluate methodologies for estimating the emissions impact of mitigation actions.

GAPS

- In the United States, systems track policy outcomes, but not necessarily emissions outcomes. Many mitigation actions are designed with goals other than or in addition to climate mitigation—such as expanding renewable energy capacity, weatherizing homes, or developing local economies. For these policies, tracking

systems often focus on outcomes other than emissions; these performance data are not consistently translated to mitigation estimates. While these systems may be adequately serving discrete policy-specific purposes, they do not facilitate a broader assessment of the policy's effectiveness, nor of the broader climate policy portfolio's effectiveness.

- In China, assessments of the impact of mitigation actions do not clearly present data sources and methodologies. There is limited third-party and public review of data, methodology, and tracking systems as a whole, and internal review processes are not transparent.

In some cases, there is inadequate review of data submitted by entities that may have an incentive to falsify data, i.e. where the reported data is connected to some potential reward or punishment for the reporting entity. This has been an issue for some voluntary programs in the United States (see case study on page 31) and may also be a concern for reporting by local officials in China.

The good practices and gaps among current tracking systems are partly a result of the relative roles played by international and domestic policy frameworks. Tracking systems for emissions and mitigation actions have largely been driven and shaped by international processes, namely the UNFCCC and (for its member states) EU climate efforts. The importance of international obligations in driving domestic MRV suggests that international processes will also play an important role in helping countries fill some of the existing gaps in MRV.

Still, domestic policy priorities are an important driver of MRV activity. China's detailed tracking of energy measures, as well as its annual reports on climate-related activities, are driven by domestic demands. Germany's commitment to renewable energy has included the development of tracking systems for its renewables policies. In the United States, recent funding for renewable energy and energy efficiency programs has come via an economic stimulus package that included new

provisions to track outcomes such as job creation. These domestic systems go beyond international requirements in providing information on the progress of climate policies, which suggests that where domestic policymakers are setting serious and clear goals, they do find value in tracking progress toward those goals.

Differences in the effectiveness of domestic systems for tracking emissions and mitigation actions also reflect differences in countries' overall capacity for MRV. Countries that already have extensive systems for data collection, review, and reporting in other areas—such as tracking compliance with environmental regulations, or

reporting detailed industry statistics—can extend those systems to track climate-related information. Where existing systems are weak or absent, beginning to track climate data is a much larger task.

Evolving international and domestic policy processes continue to expand and change the demands for MRV in these countries. In a forthcoming study, CPI will assess how well-positioned each of these four countries is to meet its own emerging needs for MRV, and what specific actions each could take to best meet its MRV needs in the future.

Glossary

AGEE-Stat	Working Group on Renewable Energy Statistics (Germany)
BMU	Ministry of Environment (Germany)
CH₄	Methane
CO₂	Carbon dioxide
CoGIS	Commission for Guaranteeing Statistical Information (Italy)
CTE	Technical Committee on Emissions (Italy)
DOE	U.S. Department of Energy
EEA	European Environment Agency
EEG	Renewable Energy Sources Act (Germany)
EIA	U.S. Energy Information Administration
EPA	U.S. Environmental Protection Agency
EU ETS	European Union Emissions Trading System
FYP	Five-Year Plan (China)
GAO	U.S. Government Accountability Office
GHG	Greenhouse gas
IEA	International Energy Agency
IEKP	Integrated Energy and Climate Program (Germany)
IPCC	Intergovernmental Panel on Climate Change
ISPRA	Institute of Environmental Protection and Research (Italy)
ISTAT	Italian Statistical Office
MRV	Measurement, reporting, and verification
N₂O	Nitrous oxide
NBS	National Bureau of Statistics (China)
NDRC	National Development and Reform Commission (China)
NIR	National Inventory Report
OMB	Office of Management and Budget (United States)
PV	Solar photovoltaics
QA/QC	Quality assurance/quality control
R&D	Research and development
Sistan	National Statistics System (Italy)
SME	Statistics Indicators, Monitoring, and Examination system (China)
tCO₂e	Metric tons carbon dioxide equivalent
TERNA	National Independent System Operator (Italy)
UBA	Federal Environment Agency (Germany)
UNFCCC	United Nations Framework Convention on Climate Change

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