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RESEARCH ARTICLE



National climate change mitigation legislation, strategy and targets: a global update

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ABSTRACT

Global climate change governance has changed substantially in the last decade, with a shift in focus from negotiating globally agreed greenhouse gas (GHG) reduction targets to nationally determined contributions, as enshrined in the 2015 Paris Agreement. This paper analyses trends in adoption of national climate legislation and strategies, GHG targets, and renewable and energy efficiency targets in almost all UNFCCC Parties, focusing on the period from 2007 to 2017. The uniqueness and added value of this paper reside in its broad sweep of countries, the more than decade-long coverage and the use of objective metrics rather than normative judgements. Key results show that national climate legislation and strategies witnessed a strong increase in the first half of the assessed decade, likely due to the political lead up to the Copenhagen Climate Conference in 2009, but have somewhat stagnated in recent years, currently covering 70% of global GHG emissions (almost 50% of countries). In comparison, the coverage of GHG targets increased considerably in the run up to adoption of the Paris Agreement and 89% of global GHG emissions are currently covered by such targets. Renewable energy targets saw a steady spread, with 79% of the global GHG emissions covered in 2017 compared to 45% in 2007, with a steep increase in developing countries.

Key policy insights



- The number of countries that have national legislation and strategies in place increased strongly up to 2012, but the increase has levelled off in recent years, now covering 70% of global emissions by 2017 (48% of countries and 76% of global population).
- Economy-wide GHG reduction targets witnessed a strong increase in the build up to 2015 and are adopted by countries covering 89% of global GHG emissions (76% not counting USA) and 90% of global population (86% not counting USA) in 2017.
- Renewable energy targets saw a steady increase throughout the last decade with coverage of countries in 2017 comparable to that of GHG targets.


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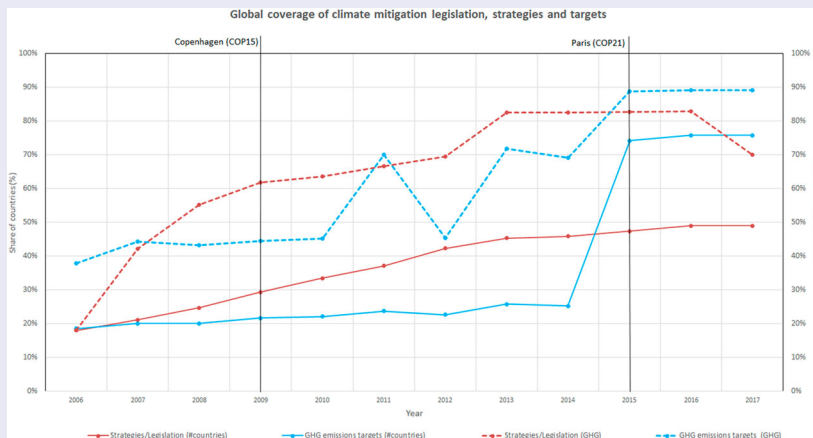
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- Key shifts in national measures coincide with landmark international events – an increase in legislation and strategy in the build-up to the Copenhagen Climate Conference and an increase in targets around the Paris Agreement – emphasizing the importance of the international process to maintaining national momentum.



1. Introduction

Global climate governance has undergone a substantial shift between 2009, when the Copenhagen Climate Conference (the 15th Conference of the Parties – COP 15) to the United Nations Framework Convention on Climate Change (UNFCCC) was held, and 2015, when the Paris Agreement was adopted. From long-standing efforts to negotiate a predominantly top-down governance architecture, the Paris Agreement represents a shift to a hybrid structure that substantially rests on bottom-up national pledges. These pledges, or Nationally Determined Contributions (NDCs), are aimed at limiting the increase in global temperature to well below 2°C above pre-industrial levels and to pursuing efforts to limit it to 1.5°C. Although the sum of the NDCs currently falls short of this aim (Höhne et al., 2017; Rogelj et al., 2016; UNEP, 2017, p. 2017), the Paris architecture is designed to ratchet up national pledges through a series of top-down nudges, including a global stocktake exercise, to be conducted every five years beginning in 2023 (UNFCCC, 2015). Understanding the full impact of these internationally declared yet nationally determined pledges will require exploring and tracking how they complement actual national climate *actions* by means of legislation, strategy and targets in countries.

This paper updates and expands on an earlier (2013) paper that analysed trends in the establishment of climate legislation and/or national strategies in almost all UN member countries between 2007 and 2012 (Dubash, Hagemann, Höhne, & Upadhyaya, 2013). Reflecting the global conversation at the time, the paper was motivated by the proliferation of national policies and actions, a trend that has only increased in the intervening years (Burck et al., 2017; Nachmany, Fankhauser, Setzer, & Averbchenkova, 2017). The construction of a new global climate architecture focused on promoting action at national scale reinforces the need to track and analyse national climate legislation, strategy and targets.

This study, building on previous research, provides a comprehensive review of national climate legislation and strategy on climate mitigation for the decade of 2007–2017. The scope of the paper encompasses 194 countries; almost all of the UNFCCC members. Significantly, it focuses on countries' domestic measures, rather than on international statements of intent alone. In addition to the previous paper, this study also examines the prevalence of targets, notably on greenhouse gas (GHG) emissions, renewable energy and electricity, and energy efficiency, including countries' NDCs. By spanning the critical climate negotiation events of COP 15 in Copenhagen in 2009 and COP 21 in Paris in 2015, the paper enables an assessment of the effects of international climate negotiations on national legislation, strategy and target setting. To enable comprehensive

comparative metrics, the results are presented with respect to time, number of countries, global emission shares and global population shares, both globally and across geographical regions. Collectively, the paper provides an important snapshot of climate legislation, strategy and targets every five years, and indicates trends in each of these over time.

After a review of the methods applied so far in the literature (section 2), we describe our method in detail (section 3) followed by results (section 4) and conclusions (section 5).

2. Tracking climate action: a review of studies

With the growth in national climate legislation, strategy and targets aimed at climate mitigation – collectively referred to as ‘climate action’ in this paper – the literature on national climate policy-making has expanded over recent years. For example, an important line of research seeks to discuss mechanisms through which climate actions work through national systems, by exploring and comparing climate governance using national case studies (Bang, Underdal, & Andresen, 2015; Harrison & Sundstrom, 2010; Held, Roger, & Nag, 2013). Another strand of literature, to which this paper seeks to add, focuses less on underlying causal explanations within a country and seeks to track and explain development in climate action over time across multiple jurisdictions (CAT, 2016; Dubash et al., 2013; GRI, 2017). This strand of literature suggests that international policy diffusion plays a significant role in global climate policy by spreading legislation in countries that do not have formal obligation to any treaty agreement, thus complementing formal treaty obligations (Fankhauser, Gennaioli, & Collins, 2016). Significantly, these two literatures are complementary and collectively provide greater insight than each separately. These two strands are further supplemented by studies focusing on the local, sub-national level (Jänicke, 2017; Jörgensen, Jogesh, & Mishra, 2015; Liu, Matsuno, Zhang, Liu, & Young, 2013) and the role of non-state actors (Bäckstrand, Kuyper, Linnér, & Lövbrand, 2017; Chan et al., 2015; Chan, Falkner, Goldberg, & van Asselt, 2018; Hale, 2016) – both important areas of research, but which remain outside the scope of this paper.

This paper seeks to contribute to the literature in the second category of multi-country studies by undertaking a comprehensive survey of climate action for mitigation purposes up to May 2017. The wide range of such studies (some compared in Table 1) collectively provide a kaleidoscopic overview of how policy-making for climate mitigation has slowly but steadily expanded as a key part of national planning. For taxonomic purposes, multi-country studies are usefully divided into two further categories, based on whether they are evaluative or comprehensive.

The evaluative category focuses on a relatively small group of countries, enabling them to assess both prevalence and stringency of climate action in national policies or NDCs. These studies typically concentrate on major emitters whose pledges or performances are ranked or rated using a variety of approaches, including composite indices, projections, case studies and qualitative interviews (Averchenkova & Bassi, 2016; Burck et al., 2017; CAT, 2017).¹ For example, Averchenkova and Bassi (2016) assess the credibility of G20 countries’ NDC pledges, and hence, study stringency by using both qualitative and quantitative indicators across four parameters. Climate Action Tracker (2017) estimates future emissions resulting from national policies for 32 countries and benchmarks performance against global targets. By comparing countries’ performance, these studies aim to identify climate leaders and laggards.

The comprehensive category of studies, of which this paper is a part, seeks to focus on breadth across countries, providing a comprehensive look at the spread of climate action. These efforts do not rank or rate countries’ performance, but rather examine the prevalence of climate action, without evaluating their stringency. While this allows them to steer clear of subjective metrics, it limits them to documentation rather than evaluation. These studies vary in their emphasis and source material – some focus on legislation while others, including this study, also look at specific sectors (GRI, 2017). Most give prominence to domestic data sources (Nachmany et al., 2017), while others, such as WRI-CAIT, limit themselves to international sources (WRI, 2017). They all seek to cover a large swathe of countries, ranging, in the examples cited above, from 164 to 194 nations.

This literature has expanded greatly in the last five years. In particular, the documentation of climate action has become more systematic. For example, the repository of climate change laws of the world (Nachmany et al., 2017) is comprehensive in its coverage of countries and climate laws. The Climate Policy Database (NewClimate, Wageningen University & Research and PBL Institute, 2017), which was used as a collection tool for this study,

Table 1. Overview of efforts to track national climate policy.

Study	Germanwatch Climate Change Performance Index (2017)	CAT NDC Assessment (2017)	Grantham: Beyond the targets (2016)	WRI-CAIT Climate Data Explorer INDC Dashboard (updated 2017)	Climate Change Laws of the World Database (2017) ^a	National Climate Change Mitigation Legislation and Strategy Survey (this article)
Central question	How do countries compare on their climate change performance in relative terms?	What are the effects of current domestic climate policy and INDC initiatives for future emissions and overall levels of warming?	How credible are the countries INDC pledges?	What information is provided by countries on mitigation through their INDCs?	What domestic climate change or climate change relevant legislation (laws and policies) exist for 164 countries?	What national framework of climate legislation and policy is in place and how it has evolved between 2007 and 2017?
Method	Assessment based on a composite index composed of emission levels, development of emissions, current and projected levels of renewable energy and energy use, and global and national climate policy; quantitative data are supplemented with expert interviews	Mixed-method analysis combining historical data and comparable cases to model policy implementation and effect on emissions for each country	Assessing the policy credibility of a country's INDC based on a set of qualitative and quantitative indicators and information	Assessment of national GHG mitigation contributions based on INDC using maps	Database of legislation, executive orders and litigation pertaining to climate or climate-related topical areas (deforestation, overfishing, etc.) in countries for assessing global legislative trends	Survey of all the UN member states and categorization of national climate action based primarily on official government websites
No. of countries studied	56 and European Union (EU)	32	G20 including EU	191 countries represented by 164 INDCs	164	194
Scope	Recent trend and level of: GHG emissions, renewable energy penetration, energy use, national and international climate policy	NDC commitment as part of the Paris Agreement and its national implementation	INDCs commitment as part of the Paris Accords of the G20 countries	NDC information: Mitigation contribution type, GHG target type, level of reduction commitment, GHG emission levels	All national-level climate change-related legislation, executive orders and litigation, defined widely	National climate legislation and strategy
Assessment of stringency	Yes	Yes	Indirectly assessed by means of credibility	No	No	No
Benchmarked against global targets	Partly	Yes	No	No	No	No
Basis for categorization	Ranking based on index score	Rating against a broad literature review of quantitative evaluations complemented by own analysis of what could be considered a 'fair' contribution to the 2°C/1.5°C limit	Rules and procedures, Players and organizations, Norms and public opinion, and Past performance (in meeting international commitments and domestic policies)	Information provided in the INDCs	Collation of climate change legislation (laws and policies) in countries to develop a database on approach, legislative and executive portfolio, litigation and legislative process	Each country categorized as either (1) national climate legislation; or (2) national climate strategy and coordinating body; (3) neither of the above; or (4) analysis incomplete.
Source	Burck et al. (2017)	CAT Country Ratings of NDC Assessment (2017)	Averchenkova and Bassi (2016)	WRI (2017)	GRI (2017), Nachmany et al. (2017)	Dubash et al. (2013) and this paper

^aThe Climate Change Laws of the World Database is continuously updated. At the time when this study was conducted, it covered 164 countries. Since then it has expanded to global coverage (197 countries) in early 2018.

includes a comprehensive overview of policies of selected countries. Moreover, the introduction of NDCs has created a database of national actions, although these do not, as yet, follow a common template.

The global regime is currently moving towards common frameworks for assessment of NDC implementation. Having such frameworks could provide avenues for conducting uniform comparisons across many countries, thus improving the reliability of findings. Nevertheless, as of now, studying the spread of legislation, strategies, targets and other such forms of climate action remains one of the most reliable means to assess the propagation and performance of mitigation efforts.

3. Rationale, approach and methods

The approach used in this paper complements existing literature. Firstly, it seeks to be comprehensive across all Parties to the UNFCCC. However, unlike other such comprehensive studies (GRI, 2017; WRI, 2017), this study relies on *domestic* sources for national climate legislation and strategy (targets are drawn from a mix of international and domestic sources, as discussed below). This approach allows this study to be comprehensive, as well as to focus on domestic action, rather than international statements of intent alone. Secondly, unlike another widely used study of legislation (GRI, 2017), this study uniquely examines national executive strategies by privileging the presence of a coordinating body. While legislative approaches are binding in nature, executive approaches are non-binding. Presence of a coordinating body emphasizes the commitment towards policy pronouncements in the latter cases, thus capturing the significant effect that non-binding strategies have also had on national action. Thirdly, this study includes national legislation, GHG targets, and renewable energy and energy efficiency targets, providing a larger scope than other studies. Finally, the output data are displayed against a range of different parameters, including number of countries, proportion of emissions, and proportion of global population, while taking account of regional variations. Notably, showing the adoption of assessed indicators in terms of population coverage is unusual in the literature, but important as larger populations, especially from developing countries, will drive future economic activity and related emissions. In 2015, non-Annex I countries included in this study accounted for 82% of global population, but only 61% of global GHG emissions (based on data used in this study – see below).

Consequently, this paper provides an authoritative compilation of various forms of climate action, albeit without assessing their stringency or effect. The value of doing so is that the existence of such efforts, in addition to potentially demonstrating compliance with international pledges, can play an important role in creating conditions for mitigation actions on the ground through three pathways: spurring policy formulation, providing a basis for mainstreaming climate objectives into broader policy-making; and becoming a focal point for the efforts of national actors such as, policy-makers, administrators, NGOs and the private sector. In brief, while the existence of climate legislation and strategy may not be sufficient for enhanced mitigation action – in fact, global GHG emissions are still rising – it is highly likely to create enabling conditions for such action, and thereby enhance its likelihood. This logic informs both the earlier 2013 study and this paper. Notably, this approach contributes an important component to the understanding of domestic climate action. Complementary studies could include stringency and performance assessments of existing actions, and case studies on the causal dynamics through which those actions are established and have effect (Averchenkova & Bassi, 2016; Burck et al., 2017; CAT, 2017). In addition, studies of sub-national scale action and role of non-state actors are likely to grow in importance. Indeed, as climate actions mature and move to the implementation stage, the emphasis should increasingly shift to evaluative studies, including at sub-national levels. However, at this early stage of climate action formulation, a comprehensive review, such as is attempted here, is an important starting point.

The methods in this paper are designed to avoid normative judgements and are based on clear decision rules and guidelines for categorization. They also deliberately follow and extend the approach undertaken in Dubash et al. (2013), to enable consistency across time periods.² The country scope includes almost all Parties to the UNFCCC.³ The paper was extended to include GHG targets, renewable energy and electricity targets, and energy efficiency targets. The rationale for assessing energy-related targets (renewable and energy efficiency) aside from GHG emissions targets, was not only that these are the most commonly used targets in climate mitigation, but also that energy production and consumption are the major sources of GHG emissions. Furthermore, while we recognize that agriculture and forestry specific targets, such as halting deforestation, would play a key

role in countries such as Indonesia or Brazil, these targets would be less relevant for countries with little to no forests and agricultural production.

To categorize climate legislation and strategy, the following coding system (Figure 1) was used: (1) if a country has climate legislation or legislative targets (passed by the Parliament or equivalent body with legislative power); (2) if a country has climate strategies or executive targets (not passed as law, but only as a measure/policy at the governmental/ministerial level). Here, an additional requirement for executive climate strategies (not for targets) to qualify is the existence of a designated coordination body to indicate implementation intent; (3) if a country has no such legislation, strategy or target; and (4) if the assessment could not be performed due to unavailability of official documents or translations in a language accessible to the team, or a lack of coverage by most comprehensive databases. Figure 1 shows a summary of this methodological approach. We include a coordination body in (2) to separate it from a political statement of intent, but not in (1) as we assume that legislation includes provisions for institutional coordination. For further details on categorizations of each indicator, please consult Supplementary Material 1.

To perform the country categorization, existing policy databases and the UNFCCC National Communications were first verified. In addition to these sources, official government websites were analysed, where possible, and a thorough internet search was performed, using specific keywords in English, but also Spanish and French, when suitable. A complete list of the major databases used is provided in the Supplementary Material 2.

We assessed official documents of strategies and legislation in detail to determine their comprehensiveness and suitability. If external databases mentioned the existence of a legislation or strategy, but we did not find the original or translated document of this measure, the respective countries were scored 4 (analysis incomplete). Targets (GHG, renewables and energy efficiency) were taken into account whenever they were defined in a policy or law, regardless of its general comprehensiveness. All overarching GHG emissions targets were included, whether defined in terms of absolute emissions, emissions intensity, or other metrics, and the same holds true for renewables and energy efficiency targets, which were defined as shares of energy production or consumption, total saved energy, renewables installed capacity or otherwise. Additionally, targets for 'non-fossil fuels', 'clean energy' or 'indigenous sources' were included as these are likely to be covered partly by renewables. Targets formulated as political statements were not counted if not included in a policy or law. In terms of international pledges, GHG emissions targets under the Kyoto Protocol were included as legislative targets, due to their legally binding nature. Furthermore, all types of targets in the NDCs were included as executive targets, as these are nationally determined and adopted through the Paris Agreement, but not legally binding. No other international pledges were included. Country-specific sources and additional detail on strategies, legislation and targets can be found in the Excel document of the Supplementary Material.

GHG emissions targets were included only if they covered at least the energy sector and at least CO₂ emissions. However, in most countries, these targets had an overarching coverage of sectors, including Land-Use, Land-Use Change and Forestry (LULUCF). Furthermore, we counted energy efficiency targets only when these targets covered all sectors. However, given the high potential for renewables in the electricity sector specifically, targets for renewables that only cover electricity generation or consumption were included. While energy efficiency targets were counted only when defined with an economy-wide coverage, we acknowledge that such targets are often set on a sectoral level and hence this category is likely to only yield partial coverage.

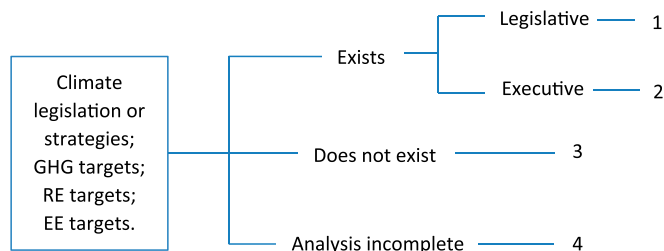


Figure 1. Summary of country categorization approach.

Only policies and targets available online by May 2017 (data collection cut-off date) were included. Furthermore, for each cut-off year (2007, 2012 and 2017) only policies and targets that continued to be in place at the end of the assessed year were accounted for.

Data on GHG emissions coverage were obtained using the PRIMAP database, v1.1 with extrapolations (Gütschow, Jeffery, Gieseke, & Gebel, 2017). For strategies, legislation and GHG emissions targets the GHGs included under the 1997 Kyoto Protocol,⁴ including LULUCF, were used (PRIMAP category CAT0, KYOTOGHG). However, this study only accounts for the coverage of CO₂ emissions (PRIMAP, CAT0, CO2) or energy-related emissions (PRIMAP, category CAT1, KYOTOGHG) when GHG emissions targets addressed only these areas specifically. Furthermore, renewable energy targets and energy efficiency targets were counted as covering energy-related GHG emissions only (PRIMAP, CAT1, KYOTOGHG). For population coverage, United Nations Population Division data for total population are used (UN-DESA, 2017).

As this paper covers all four indicators starting from the year 2000, it also re-assessed climate strategies and legislation for 2007 and 2012 that were analysed in the earlier paper (Dubash et al., 2013), so as to account for improved data availability. Following this re-assessment, changes in scoring emerged for a small number of countries as follows: additional data allowed for the assessment of countries that were previously scored 4 (analysis incomplete); strategies that were introduced in or closer to 2012 but made available online in an accessible language at a later stage were only captured in this paper; new information could be retrieved from more recent sources such as the NDCs but could not be corroborated with official documents or respective translations (leading to scores of '4' for all years). The Excel file in the Supplementary material transparently shows the scores of this paper next to those of the earlier paper, as well as the rationale and sources used in each case.

We group the country results in geographical regions and differentiate by Annex I and non-Annex I countries, as defined in the UNFCCC and in the Kyoto Protocol. We include the Annex classification because doing so allows consistent comparison across time, which is also useful because the Paris Agreement makes consistent reference to 'developed' and 'developing' countries while avoiding the Annex-based categories.

4. Results

The results are presented for three points in time – 2007, 2012 and 2017. The intervals between these years capture key transition moments in the international climate policy debate. Thus, the analysis allows an examination of correlated national measures over these periods. The period from 2007 to 2012 (referred to as Period I) represents a period during which many developing countries, in particular, faced political pressure to develop national strategies in the build-up to the negotiations process around the 2009 Copenhagen COP. Period II, from 2012 to 2017, spans the Paris COP of 2015, in the run up to which most countries tabled pledges, subsequently labelled (intended) NDCs allowing various analyses of national measures related to those NDCs. Here, the results for climate legislation or strategy, GHG emissions targets, renewable energy targets, and national energy efficiency targets are examined.

4.1. Climate legislation and strategy

By 2017, almost half of the assessed countries had put in place either climate legislation or strategies (Figure 2). The greatest increase in climate legislation or strategy, taken together, occurred during Period I, with only an incremental increase during Period II (Figure 3(a)). Over Period I, 21% of countries (41 countries) with climate legislation or strategy increased to 42% (82 countries).⁵ Over period II, this number only increased modestly to 48% (94 countries). Climate legislation, which represents a nationally binding measure, and is, therefore, harder to reverse than strategy or policy, only increased modestly from 16% to 21% to 24% over the 10-year period. More than 75% of Annex I Parties already had climate legislation in place in 2007, likely reflecting, in most cases, efforts to implement their legally binding targets under the Kyoto Protocol, which entered into force in 2005. There has also been a small but noticeable increase in non-Annex I countries with climate legislation between 2012 and 2017. However, the greatest change is in climate *strategies* in non-Annex I countries, particularly in Period I, but continuing in Period II.

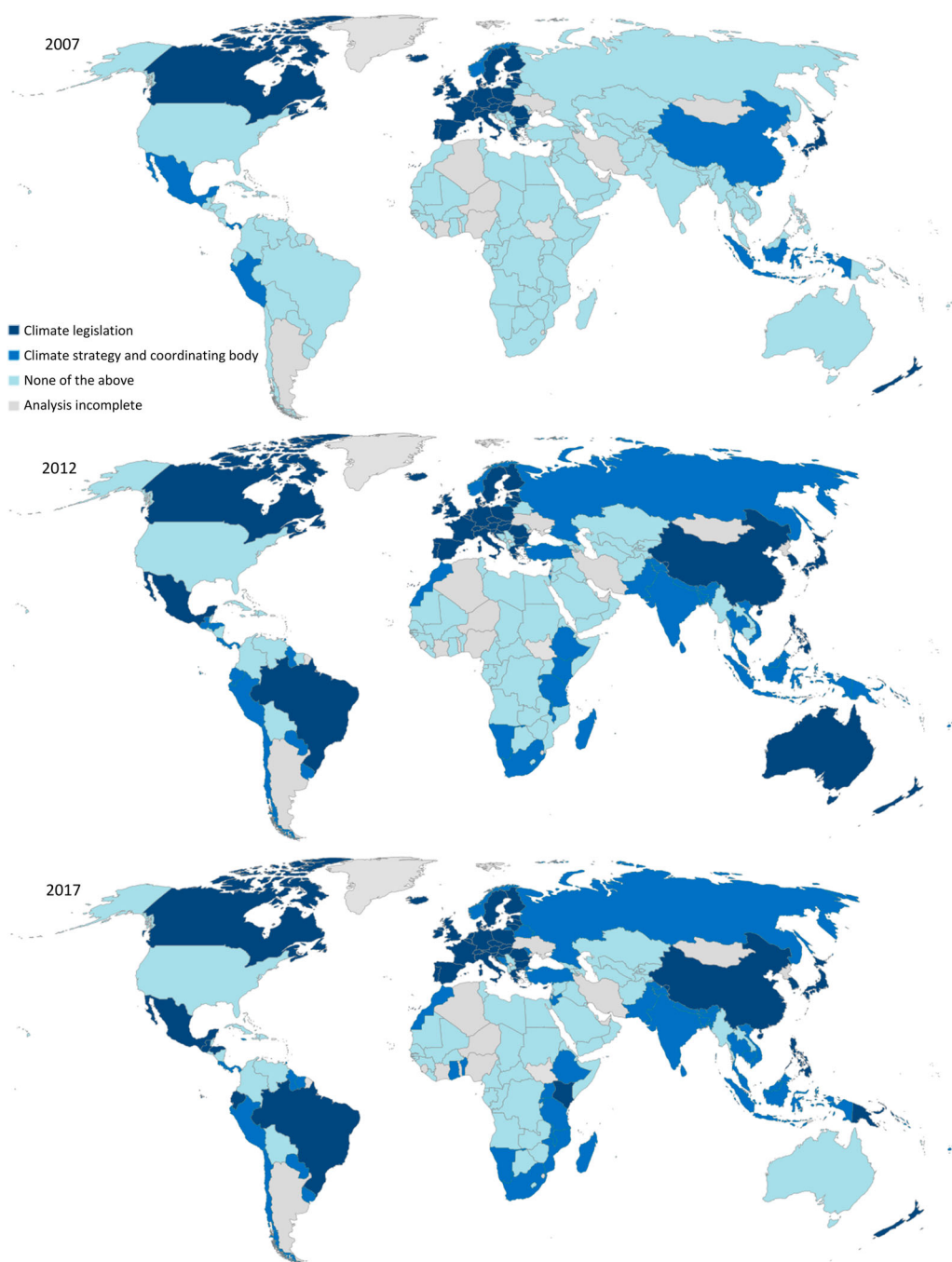


Figure 2. Climate legislation and strategies in 2007, 2012 and 2017.

Taken together, these data indicate that the period between 2007 and 2012 that included COP 15 in Copenhagen in 2009, and COP 16 in Cancun in 2010, represented a big step towards more widespread national measures, driven particularly by the uptake of climate strategies across the developing world. This trend has consolidated at a slower pace in Period II but, as we discuss below, Period II was more closely associated with the setting of targets around the Paris negotiations session.



Figure 3. (a) Shares of countries with climate legislation and strategies; (b) Shares of population under climate legislations and strategies; and (c) Shares of GHG emissions under climate legislations and strategies – in 2007, 2012 and 2017. Note: AI = Annex I countries; NAI = Non-annex I countries; AFR = Africa; ASIA = Asia; EUR = Europe (incl. Russia); NAM = North America; CSA = Central and South America; OCA = Oceania.

While the number of countries with climate legislation or strategies in place by 2017 is limited (48%), the picture becomes more nuanced in terms of population and emissions covered (Figure 3(b,c)). For example, between 2007 and 2012, the adoption of legislation and strategies is far higher in terms of population and emissions coverage than the percentage of countries covered. This suggests that larger emitting nations are disproportionately represented among the early movers in terms of climate legislation and strategy. It also suggests that larger emitting nations were responding to political pressures prior to the Copenhagen COP, a conclusion borne out by Figure 11 that displays the trend over time.

Understanding trends in terms of population and emissions are also more encouraging than the picture in terms of number of countries alone. Both are, in some ways, a better metric for understanding climate change mitigation potential than the number of countries, since the first indicates the share of people globally whose economic activity is subject to climate policy, and the second directly focuses on the object of regulation, i.e. GHG emissions. Thus, 76% of the global population and 70% of total GHG emissions were covered by legislation

or strategies by 2017, with legislation alone covering a substantial 36% of the population and 44% of emissions (Figure 3(b,c)).

When legislation and strategy are taken together, in non-Annex I countries, 78% of the population and 77% of GHG emissions were covered by 2017, compared to 70% of the population and 55% of emissions in Annex I countries. In addition, by 2017 while many more Annex I countries had legislation in place, in emissions terms, a higher proportion of non-Annex I emissions were covered by climate legislation (48%) – most likely due to the disproportionate impact of China – than of Annex I emissions (38%). In population terms, the non-Annex I coverage by legislation drops to 33%, likely reflecting the role of India, which has a large population and a climate strategy in place, but not legislation. Finally, the population and emissions data reinforce the fact that the heyday of climate legislation and strategy, particularly in non-Annex I countries, was Period I, with Annex I countries likely taking steps prior to this period, and with relatively little additional coverage in Period II, a pattern that is broadly consistent with the regionally disaggregated data.

In addition to climate legislation and strategies, a wide spread of national GHG, renewables and energy efficiency targets can also be observed worldwide in 2017, with the vast majority of countries having at least one of these three types of targets in place (Figure 4, and Supplementary Material 3 for 2007 and 2012). The following sections analyse each of the three major climate change mitigation target types (GHG emissions, renewables and energy efficiency) in greater detail.

4.2. Greenhouse gas targets

If Period I saw a dramatic increase in the number of countries putting in place climate legislation or strategy, Period II saw a correspondingly dramatic change in the articulation of GHG targets (Figure 5). This analysis does not examine the stringency or adequacy of targets or their form (absolute, intensity, or other) and only partially examines their durability (assuming that executive measures can more easily be removed by new governments, while laws are more durable, given that their removal requires the approval of the legislative body). Figure 5(a) shows that, by 2017, 76% of countries had put in place an emissions target – whether legislative or executive – compared with 23% in 2012, at the start of Period II, and to 20% in 2007, at the start of Period I. The substantial increase in Period II is predominantly in the form of executive rather than legislative targets – legislative targets increased only marginally from 22% to 23% of countries – likely as part of the formulation of NDCs that largely had executive targets.

Taken together, by 2017, these targets cover a substantial 90% of global population (dropping to 86% if USA's NDC target is excluded⁶) and 89% of all global emissions (dropping to 76% if USA's NDC target

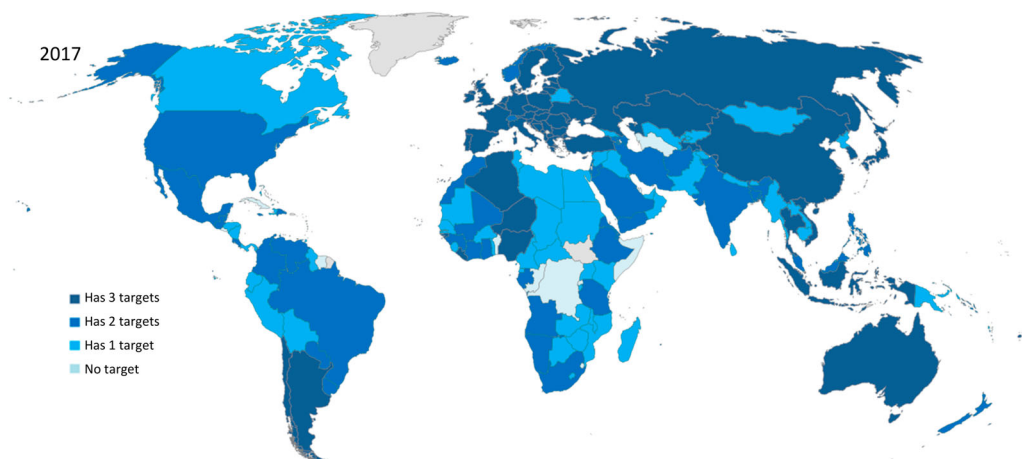


Figure 4. Number of target types (GHG, renewable and energy efficiency) in 2017. The number of targets in some countries might be higher as some could not be analysed (score 4). This figure is only indicative of the wide spread of targets worldwide.

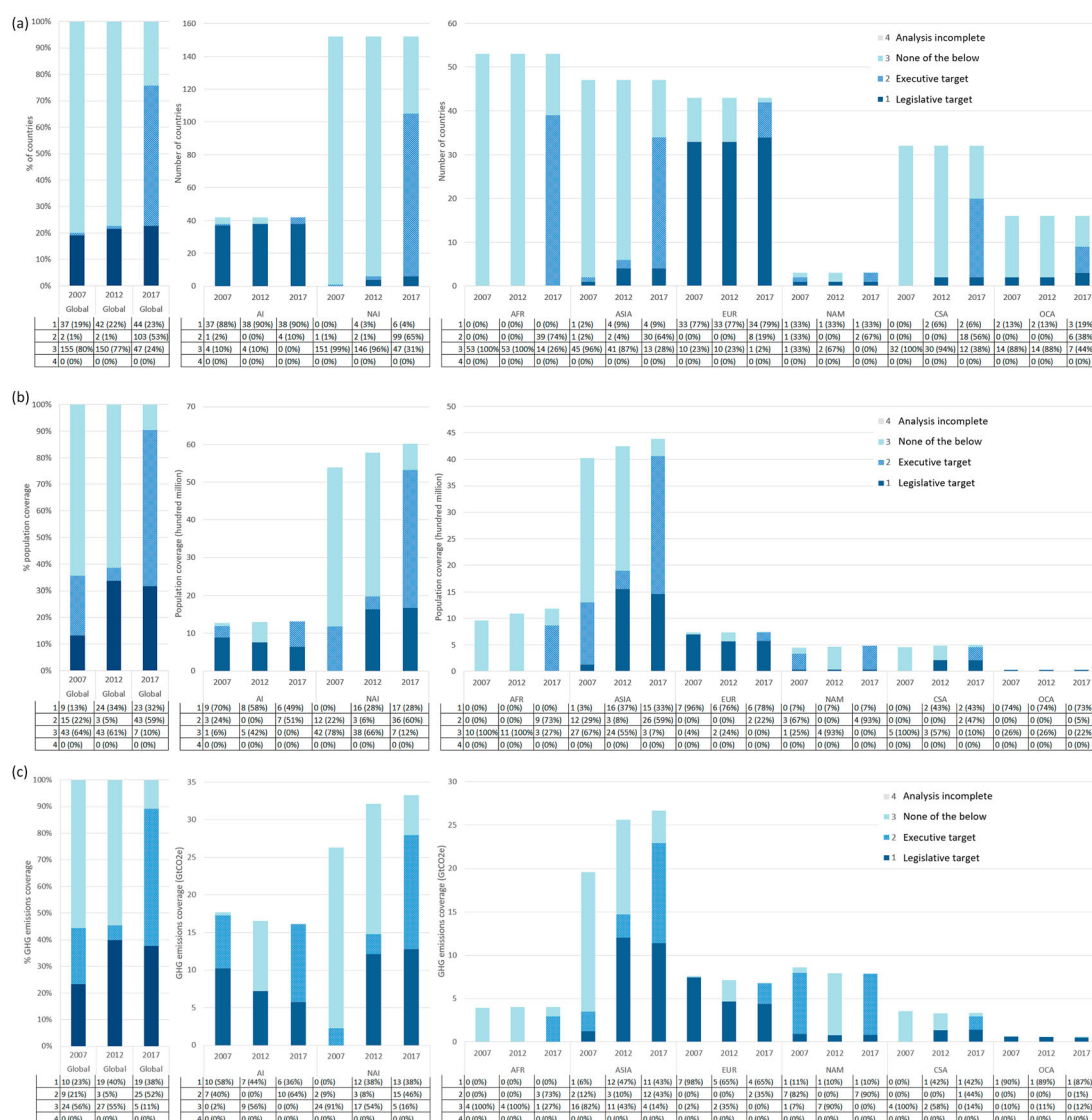


Figure 5. (a) Shares of countries with executive or legislative GHG emissions reduction target; (b) Shares of population under executive or legislative GHG emissions reduction target; and (c) Shares of GHG emissions under executive or legislative GHG emissions reduction target – in 2007, 2012 and 2017.

is excluded) (Figure 5(b,c)). While there was steady progress in Annex I countries, 90% of which already had targets in place by 2007 going up to 100% (97% without USA's NDC target) in 2017, non-Annex I countries saw a substantial jump, going from only 1% of countries having an emissions target in 2012, to 69% in 2017.

Annex I countries continue to be more likely to have legislative rather than executive targets. Thus, while 90% of Annex I countries' targets were enshrined in legislation by 2017, likely due to the adoption of the Kyoto Protocol, in non-Annex I countries, only in 4% of the countries were these legislative while 65% were executive. However, in terms of population (28%) and GHG emissions (38%) covered, a much larger share of non-Annex I targets are legislative, reflecting the extent to which China's actions affect the global aggregate data.



Figure 6. (a) Shares of countries with executive or legislative renewables target in electricity or in the energy mix; (b) Shares of population under executive or legislative renewables target in electricity or in the energy mix; and (c) Shares of GHG emissions under executive or legislative renewables target in electricity or in the energy mix – in 2007, 2012 and 2017.

4.3. Renewable energy and electricity targets

The use of targets to accelerate a renewable energy transition is a useful, albeit partial, indicator of advancing climate policy. While the achievement of renewable targets requires additional supporting measures, such as feed-in tariffs and renewable portfolio standards, the targets themselves represent an indication of ambition and send clear messages to the relevant sectors. Thus, the spread of these targets provides a complementary perspective to the spread of climate legislation/strategy and GHG targets. As countries differ in their approaches, with some adopting renewable energy targets in the total energy mix and others in the electricity sector alone, here we took into consideration both types of targets.

As Figure 6(a) shows, 71% of countries had either legislative or executive renewable energy and/or electricity targets by 2017, with a steady rise from 20% in 2007. These targets are more commonly framed as executive

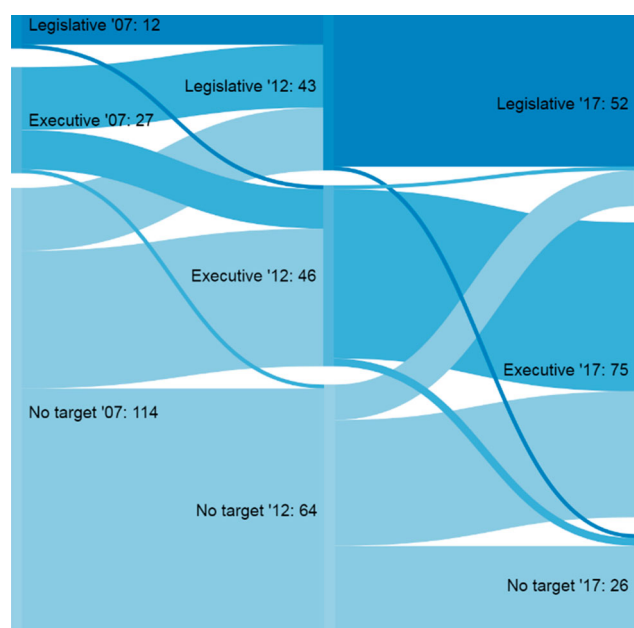


Figure 7. Number of countries changing between legislative, executive or no renewables target from 2007 to 2012 and 2017. The numbers represent the years and the number of countries in that category. Only countries that could be analysed (not scored 4) were included in this diagram, a total of 153 countries.

action (44%) rather than as legislative action (27%), with developed countries disproportionately accounting for legislative action. In 2017, 79% of Annex I countries had legislative renewable energy targets, while only 13% of non-Annex I countries had legislative targets. On a regional basis, Europe stands out as having the highest share of targets and particularly legislative targets.

As with the other indicators, the prevalence of targets is even higher when assessed in terms of population and emission shares (Figures 6(b,c)). By 2017, 87% of the global population lived in a country that adopted renewable energy and/or electricity target, and these jurisdictions accounted for 79% of emissions. Moreover, in population terms, non-Annex I countries have a higher share of population covered by targets (90%) versus Annex I countries (72%), although the share of legislative targets, which imply a greater degree of irreversibility,

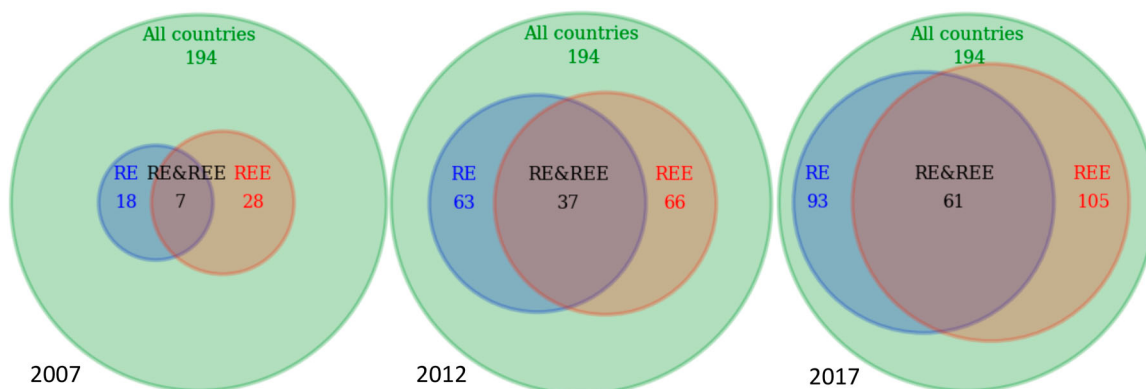


Figure 8. Circle sizes indicate the number of countries with renewable energy targets (RE) and with renewable electricity targets (REE) out of the total number of countries assessed (outer circle). The intersection between RE and REE circles shows the number of countries with both RE and REE targets.

continue to be higher in Annex I countries. The high target adoption rate in non-Annex I countries is particularly significant because most of these countries are likely to have growing future energy needs. For example, in 2017, 96% of the citizens of the populous Asian region lived in a jurisdiction with a renewable energy/electricity target, of which 44% were governed by legislation mandating a target.

The progress of renewable energy targets over time (Figure 7) shows a steady move towards legislative targets. While many countries move sequentially from no targets to executive targets through to legislative targets, a substantial share directly adopts legislative targets. Also, significantly, there are only very few cases of backsliding, either from legislative targets to executive targets or from either of these to no targets. This positive development coincides with the rapid reduction of costs in renewable energy in recent years. Similar diagrams for climate strategies and legislation and for GHG emissions targets can be found in Supplementary Material 4, while such a diagram for energy efficiency is provided in the following section.



Figure 9. (a) Shares of countries with executive or legislative energy efficiency target; (b) Shares of population under executive or legislative energy efficiency target; and (c) Shares of GHG emissions under executive or legislative energy efficiency target – in 2007, 2012 and 2017.

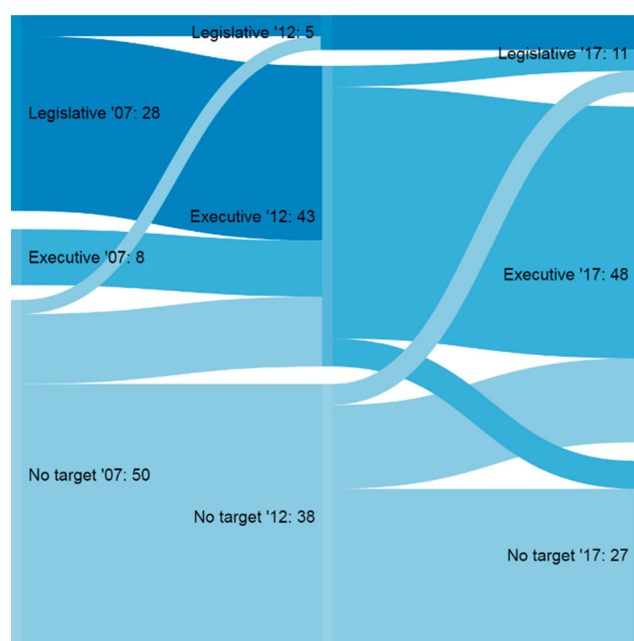


Figure 10. Number of countries changing between legislative, executive or no energy efficiency target from 2007 to 2012 and 2017. The numbers represent the years and the number of countries in that category. Only countries that could be analysed (not scored 4) were included in this diagram, a total of 86 countries.

Finally, [Figure 8](#) shows that renewable energy (93 countries) and electricity (105 countries) targets have been about as equally popular in 2017 (and in previous years), with a fairly large share of countries (61 countries) having both types of targets in place.

4.4. Energy efficiency targets

In addition to renewable energy, energy efficiency is another important area for addressing GHG emissions. In this section, we explore the spread of national energy efficiency targets. However, there are important caveats to this section. First, energy efficiency measures are frequently undertaken at sub-national scales, such as by states or provinces in federal jurisdictions or even cities, which are not represented here. Second, energy efficiency measures are often sector-specific, such as industry-specific targets or appliance-based policies, which again are not represented in a focus on national targets (Höhne, Fekete, Kuramochi, Iacobuta, & Prinz, 2015). Consequently, this section may under-represent the prevalence of energy efficiency measures. Notably, the proportion of countries for which no information could be found is also much higher than in other assessed categories, at 56% ([Figure 9\(a\)](#)). However, these data are nonetheless worth exploring because the analysed sub-set of countries (44%) account for 77% of global population and 93% of emissions ([Figures 9\(b,c\)](#)).

By 2017, energy efficiency targets were adopted in 59 analysed countries, which amounts to 69% of countries for which energy efficiency target data were available and 30% of total countries studied. Of the 30% of countries reporting energy efficiency targets in 2017, only 6% of countries reported legislative targets, a proportion which actually declined from 14% in 2007. This decline represents a shift from legislative to executive action in European countries between 2007 and 2012, before a partial reversal by 2017.

As in the case of other targets, the spread of energy efficiency targets by 2017 appears far greater when viewed in terms of population and emissions, with a coverage of 47% of total population and 73% of total emissions. These results indicate that larger emitter countries are more likely to have adopted energy efficiency targets. Furthermore, separation by Annexes also shows a high global coverage of energy efficiency targets: 95% of GHG emissions in Annex I countries and 60% in non-Annex I countries.

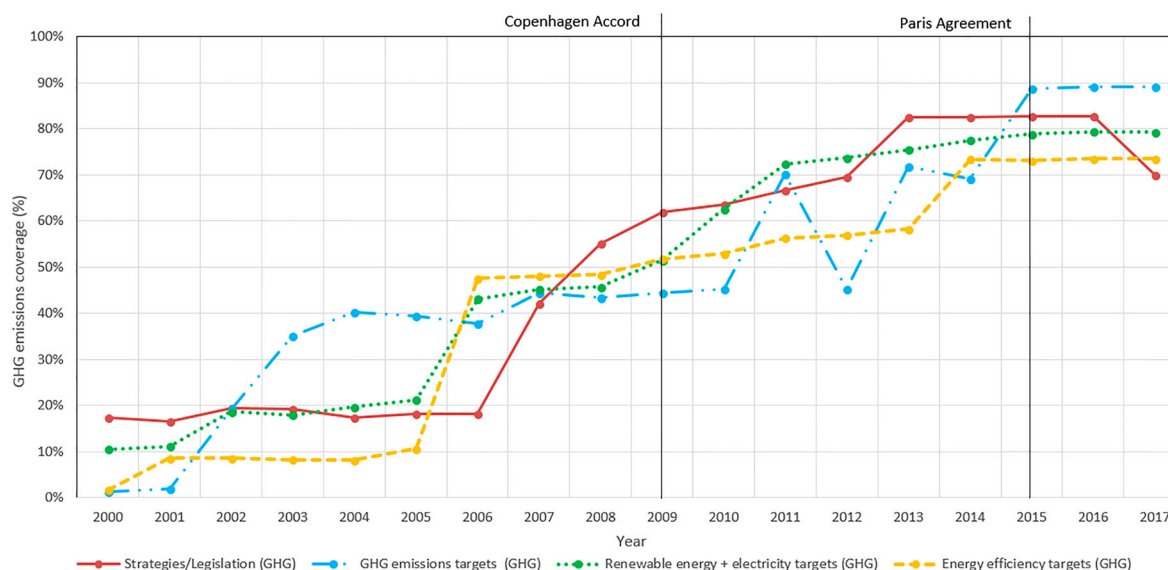


Figure 11. GHG emissions coverage by climate strategies, legislation and targets in total GHG emissions or only energy emissions (for renewables and energy efficiency targets) in the period 2000 to 2017.

Interestingly, Figure 10 shows that energy efficiency targets do not follow a linear trajectory from no target through executive target to legislative target. Indeed, in a substantial share of countries, legislative targets have given way to executive targets or have even been removed altogether.

4.5. Trends over time: what was the likely impact of the UNFCCC process?

Finally, we look at annual developments in national strategies, legislation and targets since 2000 (Figures 11 and 12). First, we observe a steep increase in the emissions under climate legislation and strategy, prior

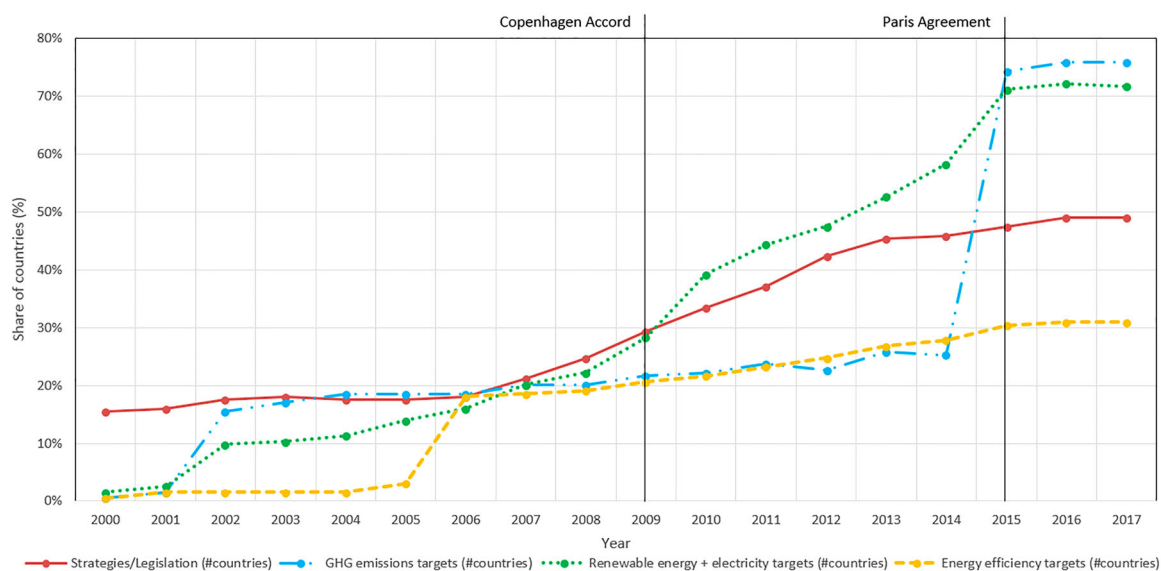


Figure 12. Share of countries with strategies, legislation and GHG emissions, renewables and energy efficiency targets in the period 2000 to 2017.

to the Copenhagen COP of 2009. Notably, this trend does not appear in [Figure 12](#) representing the number of countries, suggesting that legislation and strategy in large non-Annex I emitters, perhaps in response to political pressures in the build-up to Copenhagen, are responsible for this increase. As discussed earlier ([Figure 3](#)), Annex I countries had already adopted legislation and strategies prior to this period, likely in response to the adoption of the Kyoto Protocol (Figures 4 and 5 in Supplementary Material 5 show Annex-based trends). These results suggest that international efforts have broadened participation in climate action.

In addition, several trends are likely driven by key decisions of particular countries and regions. Thus, energy efficiency targets made a leap when the EU adopted such targets in 2005, while emission coverage of renewable energy targets jumped in 2006 due to China adopting such a target for the first time. The USA also has a discernible influence on global emissions coverage, creating a drop in GHG target coverage in 2012 (when the old target expired and a new target was not yet adopted), and with the adoption of the Obama Climate Action Plan in 2013 and its repeal by the Trump Administration in 2017 (see note 5).

At the beginning of the millennium, all four indicators started from a similar level, below 10% country coverage, except legislation/strategies (15%), but by 2017, their uptake has varied in terms of number of countries, indicating that renewables and GHG targets are the most preferred instruments (adopted by more than 70% of countries), while energy efficiency had the least traction at a national level (only 31% of countries) (as discussed above, this may be because energy efficiency targets are often set sectorally or locally, which is not captured here, and because the share of assessed countries for this indicator was low itself, 44%). The likelihood that these targets will be met may be substantially lower in those countries where a climate strategy or legislation is not yet in place. However, the development of NDCs up to Paris may have led to follow-up processes for climate strategies and legislations that have not yet been finalized, so that the number of countries with strategies and legislation in place may equal or exceed those with GHG emissions targets in the upcoming years.

5. Conclusion

This analysis presents the most comprehensive survey to date – across both time and space – of national climate legislation and strategies, and GHG, renewable energy and energy efficiency targets, covering developments since 2000 in 194 countries that are parties to the UNFCCC. This paper tracks the prevalence of the strategies and targets but does not assess their implementation or stringency. Tracking prevalence of these initiatives is important, as they are likely essential in laying the foundation for mitigation action. While legislation, strategies and targets may not be sufficient for implementation, they are likely necessary. Key conclusions include:

- By 2017, 70% of global GHG emissions (76% of the population and 48% of countries) are covered with either nationally binding climate legislation or climate strategies with a coordinating body. The increase coincides with the build-up to the Copenhagen COP in 2009 and the share has not substantially increased since then.
- 89% of global GHG emissions (76% without USA), 90% of global population (86% without USA) and 76% of countries (75% without USA) are today covered with national GHG emissions targets with a strong increase in 2015 from the development of NDCs under the Paris Agreement. This is a steep increase from a global GHG emissions coverage of 69% and a country coverage of 25% in 2014 (just before the Paris Agreement).
- Renewable energy targets saw a steady increase from 39% of the population in 2007 to 87% in 2017, and from 45% of emissions in 2007 to 79% in 2017, with a particularly steep increase witnessed during the last few years in developing countries.'
- Key shifts in national measures coincide with landmark international events – an increase in legislation and strategy around the Copenhagen COP and an increase in targets around the Paris COP – emphasizing the importance of the international process to maintaining national momentum.

We conclude that international processes have an important role to play in stimulating or enabling national action. The exact dynamic between these two levels is a subject for further study and may well vary by country: in some contexts, national action may be spurred by international negotiations; in others, national consensus may enable more ambitious international pledges, thereby creating the conditions for enhanced global collective action. In either case, this iterative dynamic between international and national policy-making processes has contributed to almost global coverage of national climate policies and targets. This underlines the importance of generating momentum in preparation towards such future key moments, for example, through the Talanoa Dialogue in 2018 or the global stocktake in 2023.

Furthermore, repeating the analysis performed in this study in the future would help follow the evolution of climate action in particular in developing countries. Although developed countries currently have a relatively high coverage of all four indicators in our analysis, developing countries have yet to reach a ceiling, while their population, economic activity and related GHG emissions are likely to cover a much larger share in the future. More importantly, given the substantial coverage of climate strategies and targets, now is the moment to ensure *effective implementation* of these strategies and targets. Indeed, the continued rise in annual GHG emissions suggests that even if an increase in national legislation, strategies and targets are a necessary condition for falling emissions, they are not sufficient. Correspondingly, future research and analysis are necessary on the stringency of the policies and targets and their actual implementation, as well as on country-specific case studies of how climate action – comprising of legislation, strategy and target – shapes outcomes.

Notes

1. Another example is the Allianz Climate and Energy Monitor which focuses exclusively on renewable electricity policies <https://newclimate.org/2017/06/29/allianz-climate-and-energy-monitor-2017/>.
2. Two changes were made from the earlier paper. First, the representations in this paper follow United Nations regional categories rather than IPCC categories, because they allow more fine-grained discussion of regional differences. In particular, placing Middle East and Africa in one category obscured potentially relevant trends. Compared to the previous study, this paper includes all previous countries, except Greenland, and adds Cook Islands and Niue (that are not UN members, but are Parties to the UNFCCC).
3. The coverage includes all Parties to the UNFCCC, except South Sudan and Palestine, two Parties that joined the Convention after the end of the first assessed period of this study (2007–2012). The European Union is also excluded as a Party, but its climate action is reflected under the individual member states.
4. Methane (CH₄), Carbon dioxide (CO₂), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs), Sulphur hexafluoride (SF₆), Nitrous oxide (N₂O).
5. Values provided in tables underneath the figures may not add up to the values in the text due to rounding.
6. The NDC of the USA, and hence its GHG target, is still counted here as existing in 2017 although the Trump Administration has announced its intent to withdraw from the Paris Agreement and cease implementation of its NDC, because the NDC is still valid until such time as this withdrawal takes effect according to the timelines enshrined in the Paris Agreement.

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