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How national governments can facilitate increased mitigation action from non-Party stakeholders: insights from urban renewable electricity and REDD+

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Foreword

This document was prepared by the OECD and IEA Secretariats in response to a request from the Climate Change Expert Group (CCXG) on the United Nations Framework Convention on Climate Change (UNFCCC). The Climate Change Expert Group oversees development of analytical papers for the purpose of providing useful and timely input to the climate change negotiations. These papers may also be useful to national policy-makers and other decision-makers. Authors work with the CCXG to develop these papers. However, the papers do not necessarily represent the views of the OECD or the IEA, nor are they intended to prejudge the views of countries participating in the CCXG. Rather, they are Secretariat information papers intended to inform Member countries, as well as the UNFCCC audience.

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Abstract

Greenhouse gas (GHG) mitigation actions will need to be accelerated and scaled up at both national and sub-national levels in order to meet the temperature goals of the Paris Agreement. National governments can play an important role in enabling GHG mitigation actions by non-Party stakeholders (NPS), and in enhancing the interaction between national policies and NPS actions. This paper explores actions national governments could take to facilitate NPS mitigation action in two sub-sectors with large mitigation potential and where NPS play a key role in the successful implementation of mitigation activities. These sectors are renewable electricity generation and procurement in cities and Reducing Emissions from Deforestation and forest Degradation in sub-national jurisdictions. This paper outlines some institutional, regulatory, financial and technical barriers faced by NPS in implementing GHG mitigation activities in these sub-sectors and highlights some examples of national policies and measures that have allowed specific NPS to overcome these barriers. The paper also showcases examples of enabling policy frameworks at the national level that could encourage the replication of such mitigation actions by NPS. An important, common element for successful replication of mitigation activities is for national governments to facilitate co-ordination with NPS; to improve consistency between national and sub-national policies; to identify and clarify responsibilities between different actors; and to regularly review and potentially revise national policies that may unintentionally create barriers to NPS mitigation actions.

JEL classifications: H70, K32, O13, Q15, Q28, Q54

Keywords: climate change, mitigation, non-party stakeholders, renewable electricity, REDD+

Résumé

Il est nécessaire d'accélérer et d'intensifier les mesures d'atténuation des émissions de gaz à effet de serre (GES) aux niveaux national et infranational pour atteindre les objectifs de température de l'Accord de Paris. Les administrations nationales peuvent jouer un rôle important en permettant aux acteurs non-Parties (ANP) à la CCNUCC de mener des actions d'atténuation des GES et en renforçant l'articulation entre les actions de ceux-ci et les politiques nationales. Le présent document examine les mesures que ces administrations nationales peuvent prendre pour faciliter l'action des ANP en faveur de l'atténuation des GES dans deux sous-secteurs où le potentiel d'atténuation est important et où les ANP contribuent de façon déterminante au succès du déploiement des programmes d'atténuation. Ces sous-secteurs sont : (i) la production d'électricité d'origine renouvelable et son approvisionnement dans les villes ; et (ii) l'atténuation des émissions dues à la déforestation et la dégradation des forêts dans les juridictions infranationales. Ce document décrit brièvement certains obstacles institutionnels, réglementaires, financiers et techniques auxquels les ANP sont confrontés ils déploient des solutions d'atténuation des GES dans ces sous-secteurs et met en avant quelques exemples de politiques et de mesures nationales qui ont permis à certains ANP de surmonter ces obstacles. Il donne aussi des exemples de cadres d'action propices à l'échelon national, qui pourraient encourager d'autres ANP à reproduire ces mesures d'atténuation des émissions. Pour que de telles initiatives de reproduction soient couronnées de succès, il est important, dans tous les cas, que les administrations nationales facilitent la coordination avec les ANP ; améliorent la cohérence entre les politiques nationales et infranationales ; qu'elles recensent et clarifient les responsabilités des différents acteurs ; et qu'elles examinent et révisent s'il y a des politiques nationales qui pourraient, de façon non intentionnelle, créer des obstacles aux actions d' atténuation menées par les ANP.

Classifications JEL : H70, K32, O13, Q15, Q28, Q54

Mots-clés : changement climatique, atténuation des émissions de GES, acteurs non-Parties, électricité renouvelable, REDD+

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List of Acronyms

ADB	Asian Development Bank
AFD	*Agence Française de Développement* / French Development Agency
AFOLU	Agriculture, Forestry and Other Land Use
BAU	Business-as-usual
BFCP	Berau Forest Carbon Program, Indonesia
BPKH	*Balai Pemantapan Kawasan Hutan* / Provincial office of the Directorate General of Forestry Planning and Environmental Arrangement, Indonesia
BSM	Benefit-sharing mechanism
CCXG	OECD/IEA Climate Change Expert Group
CO_2	Carbon dioxide
CONAFOR	*Comisión Nacional Forestal* / National Forestry Commission, Mexico
CONAREDD+	*Comissão Nacional para REDD+* / National Commission for REDD+, Brazil
COP	Conference of the Parties to the UNFCCC
CREMA	Community Resource Management Area
CTC-REDD+	*Comité Técnico Consultivo REDD+* / Technical Advisory Committee for REDD+, Mexico
EBRD	European Bank for Reconstruction and Development
ENCCRV	*Estrategia Nacional de Cambio Climático y Recursos Vegetacionales* / National Strategy of Climate Change and Vegetative Resources, Chile
EPRI	Electric Power Research Institute
FiP	Feed-in premium
FiT	Feed-in tariff
FONAFIFO	*Fondo Nacional de Financiamiento Forestal* / National Forest Finance Fund, Costa Rica
FREL	Forest reference emission level
GCF	Green Climate Fund

GCF Task Force	Governors' Climate and Forests Task Force
GDP	Gross domestic product
GHG	Greenhouse gas
GIS	Geographic information system
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit* / German Corporation for International Cooperation
GT-REDD+	*Grupo de Trabajo REDD+* / REDD+ Working Group, Mexico
GWh	Gigawatt-hour
IEA	International Energy Agency
IFC	International Finance Corporation
IMF	International Monetary Fund
INPE	*Instituto Nacional de Pesquisas Espaciais* / National Institute for Space Research, Brazil
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent power producer
IPSDH	*Direktorat Inventarisasi dan Pemantauan Sumber Daya Hutan* / Directorate of Forest Resources Inventory and Monitoring, Indonesia
IRENA	International Renewable Energy Agency
JRC	Joint Research Centre, European Commission
kWh	Kilowatt-hour
LAPAN	*Lembaga Penerbangan dan Antariksa Nasional* / National Institute of Aeronautics and Space of Indonesia
MoEF	Ministry of Environment and Forestry, Indonesia
MRV	Measurement, Reporting and Verification
MW	Megawatt
NDC	Nationally Determined Contribution
NDRC	National Development and Reform Commission, China
NEA	National Energy Administration, China
NGO	Non-governmental organisation
NPS	Non-Party stakeholder
OECD	Organisation for Economic Co-Operation and Development
PACE	Property Assessed Clean Energy
PAS	*Projeto Assentamentos Sustentáveis da Amazônia* / Sustainable Settlements in the Amazon, Brazil

PES	Payments for Ecosystem Services
PPA	Power purchase agreements
PPP	Public-private partnerships
PSAB	*Proyecto de Servicios Ambientales del Bosque* / Programme of Payments for Environmental Services, Mexico
PV	Photovoltaic
RE	Renewable energy
REDD+	Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks
SADER	*Secretaría de Agricultura y Desarrollo Rural* / Ministry of Agriculture and Rural Development, Mexico
TNC	The Nature Conservancy
UCLG	United Cities and Local Governments
UECCC	Uganda Energy Credit Capitalisation Company
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
USA	United States of America
WRI	World Resources Institute

Executive summary

Accelerated greenhouse gas (GHG) mitigation is needed to meet the temperature goals of the Paris Agreement. This requires efforts by a variety of actors, and at national, supra-national and sub-national levels. The importance of climate action at the sub-national level is explicitly recognised by both the Paris Agreement and the Glasgow Climate Pact. The mitigation potential of actions by non-Party stakeholders (NPS), e.g. sub-national governments, companies, organisations and households, is significant, and is recognised as such in some Parties' NDCs.

Parties and NPS have different abilities to identify, plan, influence, finance and implement mitigation actions. Moreover, these abilities vary from country to country, as well as by sector – reflecting the varying authorities, mandates and capacities that the wide range of NPS have in different countries and sectors.

This paper explores how national governments could facilitate increased mitigation action by NPS in two sub-sectors with large mitigation potential and where NPS could play an important role in implementing GHG mitigation actions. These sub-sectors are renewable energy (RE) and Reducing Emissions from Deforestation and forest Degradation (REDD+). This paper outlines some institutional, regulatory, financial and technical barriers faced by NPS in implementing activities in these sub-sectors. It then highlights some successful examples of how national policies and measures have allowed specific NPS (cities, for renewable electricity; sub-national governments and other NPS for REDD+) to overcome these barriers. The paper also showcases examples of mitigation actions by NPS that provide national governments with insights on enabling policy frameworks that could encourage replication of such actions.

There are many national-level policies and measures that can facilitate increased mitigation actions by NPS relating to RE in cities or to REDD+. These include general actions that national-level governments can take to help facilitate increased mitigation action by NPS such as:

- Establishing a clear "direction of travel" for GHG emissions at national level for both the short and long-term.
- Developing a holistic understanding (both supply- and demand-side) of emission reduction potentials, as well as the potential role that NPS can play in specific sectors and sub-sectors.
- Establishing an enabling legislative and policy framework, and reviewing/revising this framework where necessary in order to facilitate GHG mitigation actions by NPS.
- Explicitly delineating the roles and responsibilities of national governments vs NPS relating to encouraging, enabling, implementing and financing GHG mitigation actions and ensuring that these roles are clear and reinforce each other.
- Increasing "vertical" communication between different levels of government within the country and between governments and NPS, as well as "horizontal" communication between different government departments.
- Exploring how to increase the financial attractiveness of mitigation options for NPS, and facilitate NPS access to both national and international financial opportunities.

- Facilitating the collection of and NPS access to relevant data e.g. on mitigation potentials, costs at sub-national level.
- Facilitating benefit-sharing so that the benefits of mitigation actions accrue to actors at different levels – including local stakeholders.

There are also specific policies and measures that can be used to encourage increased levels of RE in cities or REDD+ that will need to be tailored to specific countries, (sub-)sectors, and local contexts. These encompass policies and measures that focus on developing an enabling environment (by overcoming institutional and regulatory barriers, or by increasing information/awareness about mitigation opportunities); technical issues (such as facilitating the collection of relevant information at disaggregated level); and those that provide incentives or disincentives (such as targeted subsidies, or non-compliance penalties).

NPS experience with developing or procuring RE in cities and with developing sub-national REDD+ initiatives highlights that the regulatory framework can help or hinder the implementation of GHG mitigation activities. For RE in cities, regulations governing RE access to the electricity grid are key, and are often set at the national level. An enabling national regulatory framework would allow, for instance, cities to procure renewable electricity from independent renewable electricity power producers. For REDD+, regulatory clarity on land tenure is a key enabler, as is alignment across policies in different sectors that influence land use (e.g. forestry, agriculture, mining). Ensuring that relevant national policies and measures that are in place are enforced on the ground is also important for the successful implementation of REDD+ activities.

Institutional co-ordination is another key issue for the successful implementation of GHG mitigation activities by NPS, both for RE in cities and for REDD+. For instance, national governments could improve "vertical" co-ordination for RE in cities by setting up offices in national energy ministries and regulatory agencies dedicated to co-ordinating with municipal governments. This vertical co-ordination could also enrich and strengthen national planning with on-the-ground knowledge of municipal governments, such as information and data sharing on siting distributed renewables. Vertical co-ordination is also important for REDD+ initiatives and can be institutionalised through the creation of committees that bring together actors from different levels. By doing so, vertical co-ordination can help build technical capacities of NPS as well as advance sub-national REDD+ initiatives.

Availability of data and information at a sufficiently disaggregated level is another key enabler of mitigation action by NPS for both RE and REDD+. Data and information is needed to identify potentially promising mitigation opportunities, and is also an important element in leveraging financial investments. However, such disaggregated data is often unavailable, particularly for city-level RE potentials. National governments can also help here, e.g. by providing local-level data such as on a city's renewable electricity potential, or by facilitating access by sub-national governments to satellite forest monitoring data.

Incentives (or disincentives) can help to encourage (or discourage) specific NPS GHG mitigation actions. National governments can establish benefit-sharing mechanisms that ensure that REDD+ benefits (which can be both monetary as well as non-monetary) are shared between different stakeholders involved in REDD+ activities. "Net metering", where excess electricity from distributed renewables generates financial benefits, can encourage increased use of distributed renewable electricity generation.

To conclude, a national policy framework is a crucial enabler for the increased levels of mitigation action that are needed to meet the aims of the Paris Agreement, and so is NPS action on the ground that is informed by and reflective of context-specific realities. National governments have several options to help facilitate further GHG mitigation by NPS, and to enhance the interaction between national policies and NPS actions. These options include creating an enabling regulatory and institutional framework to incentivise mitigation policies and actions by NPS, and regularly reviewing and revising this framework in order to overcome barriers to enhanced mitigation actions. Other options could address implementation barriers, such as providing incentives or disincentives for NPS actions. Facilitating co-ordination with NPS

is an underlying element for the success of these actions. This requires identifying where each actor, including NPS, can play their role in reaching national goals most efficiently, and ensuring that responsibilities of different actors are clearly defined. Increased co-ordination between national governments and NPS will also help to improve consistency between national and sub-national policies, and could also help to improve the local enforcement of national policies. Together, these actions can help increase the overall ambition of mitigation actions and thus facilitate progress to the goals of the Paris Agreement.

1. Introduction

Greenhouse gas (GHG) mitigation actions will need to be accelerated and scaled up in order to meet the temperature goals of the Paris Agreement (Masson-Delmotte et al., 2021[1]), as current GHG targets leave a significant "emissions gap" (UNEP, 2021[2]). Such effort is needed by a variety of actors, and at national, supra-national and sub-national levels. Indeed, the preamble of the Paris Agreement explicitly recognises the importance of climate action at the sub-national level (UNFCCC, 2016[3]), and the Glasgow Climate Pact reiterates the "urgent need for multilevel and cooperative action" (UNFCCC, 2021[4]). Since the adoption of the Paris Agreement, an increasing number of non-Party stakeholders (NPS), e.g. sub-national governments and companies, are developing and implementing climate actions. The mitigation potential of these actions is significant, as is recognised by several countries' NDCs – although it can be difficult to disentangle the impact of mitigation actions driven by NPS from those driven or enabled by national governments.

Parties and NPS have different abilities to identify, plan, influence, finance and implement mitigation actions. Moreover, these abilities vary from country to country, as well as by sector and individual NPS – reflecting the different authorities, mandates and capacities that NPS have in different countries. National governments often set the enabling legal, regulatory and policy framework, including national or sectoral GHG emission targets and national-level strategies. National governments also establish policies and measures, and can raise funds for GHG mitigation actions. Some NPS (e.g. sub-national governments) also have the authority to set policies in specific areas, and may have some ability to raise and/or manage funds. Other NPS such as local stakeholders may be well placed to identify specific programmes and actions that could be implemented under national and sub-national policies and targets – given their proximity to the local level where these actions are implemented. The NPS that implement specific actions (which can include local governments, as well as companies, households), may also be well-positioned to identify context-specific barriers to increased levels of mitigation action.

This paper explores how national governments can facilitate increased mitigation action by NPS in two sub-sectors with large mitigation potential where NPS are key actors in the successful implementation of actions: renewable energy and avoiding deforestation[1]. These two sub-sectors have been identified by the Marrakech Partnership as areas of concern, with deforestation rates going in the "wrong direction" and the share of renewables growing at an "insufficient pace" (UNFCCC, 2021[5]). This paper also identifies successful examples of increasing deployment of mitigation actions in these sub-sectors, and draws technical, institutional, regulatory and finance-related lessons from these experiences for national policy-makers.

This paper first lays out some relevant background and context in section 2. then does a "deep dive" on renewable energy (section 3.) and avoiding deforestation (section 4.). Conclusions are laid out in section 5.

[1] More specifically, the focus of the analysis is on renewable electricity production and consumption in cities, and on sub-national efforts to avoid deforestation and forest degradation in developing countries.

2. Background and context

Accelerating mitigation action by the gamut of relevant NPS is needed to deliver the rapid and significant emission reductions required to meet the goals of the Paris Agreement. Indeed, some Nationally Determined Contributions (NDCs) specifically highlight the importance of NPS in meeting national goals. Moreover, several NPS have also signed up to mitigation-related commitments, such as city-wide or sector-specific GHG reduction or carbon neutrality goals.

National governments can facilitate the implementation of GHG mitigation policies and actions by NPS in many ways. Firstly, governments could set the groundwork by undertaking an assessment of GHG emission reduction potential in their country. Such an assessment would ideally encompass all sectors, as well as supply and demand changes that would be needed to meet their long-term GHG goals. Secondly, national governments can steer action by establishing a policy framework that provides incentives for mitigation actions, establishes disincentives for GHG-emitting actions. Thirdly, governments can establish governance structures that facilitate co-ordination between relevant stakeholders – including different levels of government (national, regional, local). This co-ordination could help to ensure that a legislative, regulatory and institutional framework for mitigation can accommodate specific local conditions. Increased co-ordination and communication e.g. between NPS who implement mitigation actions and national governments could help governments to adjust their national policy framework so that it meets its aims more efficiently. This could lead to reduced barriers and increased levels of mitigation actions by NPS, which could in turn help national government meet their national climate goals.

This section highlights the role and significance of NPS action. It also explores the link between NPS mitigation action and mitigation actions at the national level, and how efforts by national governments can help to co-ordinate and replicate successful NPS actions.

2.1. Importance of multilevel action for climate mitigation

Increasing mitigation action by NPS has the potential to enhance overall mitigation ambition significantly. Doing so could – as acknowledged by the Glasgow Climate Pact (UNFCCC, 2021[4]) – provide a significant contribution to reducing emissions to levels needed to meet the long-term temperature goals of the Paris Agreement, and thus in meeting the "emissions gap". This gap is currently estimated at 13-28 Gt CO_2-eq in 2030[2] (UNEP, 2021[2]). A 2021 assessment of NPS mitigation action by individual cities, regions and companies in ten major economies[3] estimates that the aggregate level of NPS mitigation action in 2030 could enhance global mitigation efforts by 2-2.5 Gt CO_2eq (Kuramochi et al., n.d.[6]). The same study estimates that mitigation action by international coalitions of NPS is significantly higher, at 16 Gt CO_2eq.

[2] The 2021 Emissions Gap report (UNEP, 2021[2]) estimates the emissions gap at 13 Gt CO_2eq in 2030 compared to emissions trajectories associated with a least-cost scenario to meet the Paris Agreement's 2° C limit, and 28 Gt CO_2eq for the scenario associated with the 1.5 C limit.

[3] Brazil, Canada, China, EU27 +UK, India, Indonesia, Japan, Mexico, South Africa, United States.

The ability of different NPS to mitigate GHG emissions varies widely between and within countries. This potential is affected by multiple factors, including the purview of the NPS (i.e. which actions they are able to influence, or have authority over), national and local circumstances, and the economic potential of specific mitigation actions in different circumstances. For example, local governments are estimated to have direct influence on less than a third of the GHG emissions in their cities (Coalition for Urban Transitions, 2019[7]). Thus the proportion of urban abatement potential that is led primarily by national or state governments is estimated at 67% (Coalition for Urban Transitions, 2019[7]), although in some countries (e.g. China) this can be as high as 100% (Global Covenant of Mayors for Climate & Energy, Stockholm Environment Institute and Coalition for Urban Transitions, 2021[8]).

Many national governments have recognised the importance of encouraging increased levels of NPS action, and are taking a variety of steps to encourage such action. These include:

- Setting long-term climate goals, with consistent shorter-term targets (Falduto and Rocha, 2020[9]) as well as strategies to meet those climate goals (Jeudy-Hugo, Lo Re and Falduto, 2021[10]) as well as broader goals, such as the Sustainable Development Goals. This helps to establish a "direction of travel".
- Establishing a policy framework for climate action by NPS (including sub-national governments). For example, by requiring sub-national governments establish climate plans that are aligned with those at national level (e.g. in Indonesia), or by "disaggregating" national goals by region or sector.
- Removing or reducing technical barriers to NPS climate action. For example, by ensuring that top-down and bottom-up approaches to relevant data collection (e.g. deforestation rates, GHG emissions) are compatible, or by providing templates for sub-national plans.
- Improving co-ordination, communication and information availability about mitigation actions. This would include addressing institutional barriers such as limited vertical co-ordination (i.e. between different levels of governments), for example by establishing institutions to facilitate co-ordination. It could also include systematic policy review in key areas to allow experiences from NPS-led actions to inform national policy.
- Establishing regulations or standards that change the risk/reward profile of low-GHG activities, to make them more attractive. This can help to increase the deployment of GHG mitigation activities (e.g. by establishing a price on carbon), or to decrease the prevalence of GHG-intensive activities (such as by putting in place protected areas to reduce deforestation).
- Clarifying the roles and responsibilities of different actors in relation to mitigation actions. This will help to minimise overlap/duplication of mandates, which can in turn lead to inconsistent policy signals.
- Increasing support, or facilitating access to finance, for GHG mitigation actions by NPS. For example, the Finnish government has indicated that it will boost sub-national government action on climate, including via providing funding for local and regional actions (Finnish Government, n.d.[11]).
- Ensuring enforcement of mandatory actions or policies, to ensure that implementation is consistent and achieves the anticipated results. In the absence of such enforcement, implementation can be inconsistent (see e.g. (Adelphi and UN-Habitat, 2018[12])).

The importance of multilevel climate action is also recognised in some selected NDCs. For example, Colombia highlights that of the 148 mitigation measures that need to be implemented to meet its goal, 89 will be led by territorial entities and 24 by companies (Government of Colombia, 2020[13]), Canada's 2021 NDC highlights the role of its sub-national provinces and territories in designing carbon pricing (Government of Canada, 2021[14]) and India's NDC (Government of India, 2016[15]) highlights the role of a variety of NPS, as well as its "Smart Cities Mission" – which gives Indian municipalities more authority to shape their energy systems compared to previous central policies (Bhardwaj, De Lorenzo and Zérah, 2019[16]).

2.2. Drivers and barriers to replicating and scaling up NPS mitigation action

In order to fulfil the potential of NPS mitigation action, successful actions need to be replicated and scaled up. However, roll-out, up-scaling or replication of such actions does not always occur for a variety of reasons. These can include technical, political, institutional, regulatory and financial barriers (see e.g. (van Winden and van den Buuse, 2017[17]), (Nobuoka, Ellis and Andersen, 2015[18])). Replication requires identification and dissemination of successful mitigation interventions, as well as an assessment of where actions have not been successful, as an understanding of any specific barriers to mitigation activities is the first step in their removal.

A variety of actors have a role in identifying and disseminating successful mitigation interventions. This includes national and sub-national governments. It also includes transnational actors, such as co-ordination bodies (e.g. the Marrakech Partnership) and groups of NPS such as the Governors' Climate and Forests Task Force, Under2 Coalition, C40 and ICLEI. These coalitions of NPS have an important role in facilitating knowledge exchange between relevant actors, and can thus help to "upscale" successful actions horizontally (e.g. between different cities or regional governments within the same country, or transnationally). For example, C40 estimate that 30% of their members' climate actions are brought about via city-to-city collaboration (C40, n.d.[19]).

Political support and leadership at the regional and local level (e.g. by governors or city mayors) can also play an important role for replication and scaling-up action. This can include encouraging mitigation projects, ensuring that different sub-national climate-related plans are aligned with one another (i.e. horizontally), and helping to mobilise resources for their implementation (Fraser et al., 2022[20]). National regulations that require regions or cities to develop their own plans for GHG emission reductions can facilitate this, as in Indonesia – where local governments are required to create their own Local Action Plan for GHG reductions that are tailored to local development plans (Climate Scorecard, 2016[21]).

A good understanding of information on the non-climate benefits of projects that lead to GHG mitigation is also important. For example, an appreciation of the development benefits of mitigation activities can provide a significant impetus for increased climate action in developing countries (see e.g. (Hsu et al., 2018[22]) (Lütkehermöller, Smit and Kuramochi, 2021[23])). Non-climate benefits can be particularly significant for REDD+ projects, and include biodiversity conservation and continued access by local stakeholders to non-timber forest products.

Finance is a key enabler for climate action. As NPS, including regional and local governments, may have limited ability to raise their own funds, access to national or international sources of finance is an important issue. Even when local governments are able to access finance, they may not have the required financial management capabilities to spend funds effectively and efficiently (UNICEF, 2020[24]). National governments can help municipalities' climate efforts by providing direct support for such efforts. For example, in Luxembourg, the national government established a "Climate Pact", and provided support to municipalities that participated in this pact (LIFE PlanUp, 2019[25]). National governments can implement climate-specific levies (e.g. carbon taxes), and/or distribute tax revenue in a way that is related to environmental performance (e.g. via ecological fiscal transfers). However, the proportion of centrally-levied taxes that is distributed to sub-national governments via tax-sharing arrangements varies widely by country (UCLG, OECD and AFD, 2016[26]).

National governments can also facilitate access by NPS to international sources of finance for climate mitigation actions. For example, governments could help collate and publicise information on capacity constraints and gaps that have been highlighted to them by NPS, e.g. via the biennial transparency reports that each country is to prepare under the UNFCCC.

Access to relevant data by NPS is a key technical barrier to increased mitigation action, and an important element to leverage investments. However, there is often a lack of relevant information at city/local-

government level. National governments could help by developing data sharing systems that allow for increased availability of and access to relevant information by NPS (Carreño et al., 2021[27]).

Institutional co-ordination and communication between national and sub-national governments (as well as between national governments and other NPS) can also facilitate increased uptake of climate actions by NPS by increasing information flow. This can include direct representation of NPS e.g. on technical or policy committees where national government representatives also participate, as in Brazil's REDD+ committee (Government of Brazil, 2019[28]), or opening up proposed policy documents for comments by NPS (e.g. in Germany, see (Matsumoto et al., 2019[29]).

3. Deep dive: implementing and scaling up renewable energy use by cities

This section identifies and analyses what policies and actions national governments could take to help to scale up the use of renewable energy (RE) electricity by cities.[4] It outlines the institutional, regulatory and technical barriers faced by cities and national governments wanting to expand urban RE use, and explores whether and how national policies and measures have allowed cities to overcome these barriers. There is currently limited information on how successful national policies and measures have been in supporting municipal governments with deploying RE projects. Most of the dedicated literature focuses on the action taken by municipal governments to develop and scale-up RE projects, without necessarily illustrating examples on what role national governments, and their national policies, had in the process. Thus, the aim of this section is also to highlight successful examples of how national governments can empower cities to use greater levels of RE, which can in turn contribute to the implementation of NDCs and the global effort to mitigate GHG emissions.

3.1. Implementing and scaling up renewable energy use in cities: Importance, potential and common challenges

Cities are important players for climate action and, being "agglomerated economies",[5] they can benefit from economies of scale to implement climate action, but are also seeing increased demand for energy. Cities account for around 80% of global GDP, two-thirds of global energy consumption, and over 70% of annual global GHG emissions (UN, 2019[30]). Currently more than 55% of the global population lives in cities, and this percentage is anticipated to grow to 68% by 2050, with the fastest growth occurring in developing countries in Asia and Africa (UNDESA, 2018[31]) (REN21, 2021[32]). Many global cities are expanding to accommodate growing populations, especially in developing countries, requiring an extension of energy services to new consumers. This trend is creating significant acceleration in demand growth for urban energy infrastructure (IEA, 2021[33]). The main drivers of GHG emissions in cities today relate to energy services required for heating and cooling in buildings, appliance and electronics use, urban lighting and transport of people and goods – all of which can be significantly affected by urban planning. Moreover, electrification of transport and heating as part of the clean energy transition would increase demand for electricity in cities. Most of these effects could result in an increase of overall absolute GHG emissions related to urban activities. Cities' electricity consumption fundamentally depends on their

[4] This section does not analyse national policies and measures needed to contain or reduce the demand of electricity by cities, nor those related to the use of RE electricity in specific urban sub-sectors, such as urban transport, building or heating and cooling.

[5] Cities allow companies and people to "enjoy positive externalities from the spatial concentration of economic activities" (UN, 2020[153]). Economists consider this a distinct advantage to benefit from the gains of the economy of scale, where firms can offer lower per unit costs for larger-scale production with reduced transport and transaction costs per unit. As such, cities are often referred to as "agglomeration economies".

economic structure. If cities host manufacturing and material processing industries, they tend to be large electricity consumers; conversely, if they rely mostly on service sectors, their electricity consumption tends to be comparatively lower (IRENA, 2021[34]). At the same time, the mitigation potential in cities is large: by using currently feasible and widely available mitigation measures, GHG emissions in cities could be reduced by almost 90% by 2050. Roughly half of this mitigation potential is achievable through the decarbonisation of the electricity sector (Coalition for Urban Transitions, 2019[35]).

Cities can reduce the GHG emissions of the electricity they consume in three ways.[6] Firstly, by becoming producers of renewable electricity themselves (e.g. by installing RE projects). Secondly, by purchasing renewable electricity from utilities. Thirdly, by encouraging increased uptake of renewables from a wide range of urban actors.

However, cities' ability to implement and scale up the implementation of RE projects or their procurement for urban electricity use varies, reflecting different national as well as local circumstances (such as climate zone, demographic trends and settlement density), institutional arrangements, financial capabilities and governance. For instance, the development of solar PV systems may be more technically viable in less densely built and populated urban areas, than in dense cities with high-rise buildings and little available space on rooftops for solar PV installations (IEA, 2016[36]).

While each city is unique, cities face common challenges in implementing and scaling up RE projects and procuring RE electricity. Cities generally consume power generated outside their urban areas almost exclusively, with national or regional utilities typically supplying electricity to cities. Moreover, centralised electricity generation is also outside cities' legal jurisdiction, usually falling under the mandate of national governments. Core policies related to renewable energy that can fall into the sphere of action of municipalities include incentives for the deployment of renewables i.a. rooftop solar photovoltaic (PVs), solar thermal and electrification of public transport (IRENA, 2021[34]). However, a recent study by the Coalition for Urban Transitions shows that cities have primary authority over only 14% of the urban abatement potential to 2050 (including decarbonisation of electricity), with 19% being shared with the national government and the remaining 67% being primarily led by national governments (Coalition for Urban Transitions, 2019[35]). In practice, this means that cities usually have limited authority over large-scale, grid-connected electricity supply.

Institutional and regulatory barriers, such as little or no vertical co-ordination between the city and national government, can hinder RE project implementation. For instance, the degree of regulatory and financial power that national or regional governments grant to municipal governments directly influences the ability of cities to implement and scale up RE projects. In certain cases, national legislation might also hinder the implementation of RE projects, for instance where there are import taxes on solar PV components, or where certain practices such as net metering or community energy projects are not enshrined in law. Moreover, cities may face limited access to finance and funding for the implementation and operation of projects, including RE projects - which are generally characterised by high upfront technology costs. Some cities, especially in developing countries, also face barriers related to reliable primary city-wide data availability (e.g. on energy supply and/or demand, siting of RE systems and urban infrastructure, technology deployed) and capacity constraints.

In light of these common challenges, national governments could help cities to implement and scale up RE projects in a variety of ways. The range of potential national government measures and actions in this sense can be quite wide, including addressing institutional, regulatory, technical and other issues such as access to finance and capacity building. The following sub-sections provide an overview of possible measures and actions by national governments that could help cities of different sizes (from large to medium) to overcome specific barriers in scaling up their RE use, and provide concrete examples of

[6] Cities could also implement actions to reduce the demand of electricity (and thus, the electricity-related GHG emissions) through measures such as energy efficiency and conservation policies, digitally-enabled efficiency, and smart urban planning strategies. The analysis of these demand-side measures is outside the scope of this paper.

success where possible. The following sub-sections analyse institutional issues, regulatory barriers, technical challenges, and other issues, such as access to financing, new business models, and capacity building.

3.2. Addressing institutional issues

National governments can support the generation and procurement of RE in cities from an institutional perspective in several ways. In certain cases, national governments could facilitate governance reforms to improve co-ordination with sub-national governments, including cities, for the planning and implementation of RE projects. A lack of institutional co-ordination between the national and municipal governments can constrain or block the efforts made to scale up renewable energy uptake. The next sub-sections analyse actions that national governments could take to enhance vertical co-ordination with city-governments, to clarify responsibilities and devolvement of powers, and to tailor institutional co-ordination to local characteristics.

3.2.1. Enhanced vertical co-ordination can facilitate increased levels of renewables

Improved "vertical" co-ordination between the national government and city administrations could allow local governments to play a more active role in electricity sector planning, where possible and feasible, which could help develop new RE projects in cities. Moreover, this could enrich and strengthen national planning with on-the-ground knowledge of municipal governments, such as information and data sharing on siting distributed renewables (Coalition for Urban Transitions, 2020[37]). One option to improve such vertical co-ordination is for national governments to set up offices in national energy ministries and regulatory agencies dedicated to co-ordinating with municipal governments, while ensuring that local governments have the resources and staff to play an active role in electricity sector planning processes (Coalition for Urban Transitions, 2021[38]). National governments could also consider including other levels of governments, such as the regional level – where relevant – in the electricity sector planning process.

Vertical co-ordination is also essential for implementing RE projects. For instance, while certain countries have set specific goals for RE deployment at national level, some cities might have local conditions and ambitions that allow them to set RE deployment goals that go beyond the national target. However, co-ordination between the municipal government and the national (and regional, where relevant) governmental authorities is key for the implementation and achievement of such targets. In China, for instance, the national target for renewables' share of electricity was 27% by 2020 (China's National Energy Administration, 2016[39]). However, some individual cities (e.g. Zhangjiakou) set much more ambitious targets – corresponding to 55% of RE share in electricity generation. On top of this, a district of Zhangjiakou (Chongli district) co-hosted with Beijing the Winter Olympics in February 2022, and had set the target of achieving 100% RE electricity supply in the district by 2022. Both goals were achieved ahead of schedule (China.org.cn, 2022[40]) (Government of Zhangjiakou, 2022[41]), thanks to cross-government co-operation. For instance, to achieve the 2022 Winter Olympics goal, the Zhangjiakou Municipality and the Chongli district government worked together with several actors at different government levels.[7] This collaboration was guided by the development plan elaborated by the National Development and Reform Commission (NDRC), which was approved by State Council, then passed down to different Ministries and local level officials for implementation (Pollution Control Experts - China Environment, 2017[42]). China' National Energy Administration (NEA) also provided guidelines on construction and management, which

[7] E.g. the State Council of China, the Hebei provincial government, the Zhangjiakou Municipality government and the Chongli District government, the Special Office for 2022 Winter Olympics preparation and co-ordination.

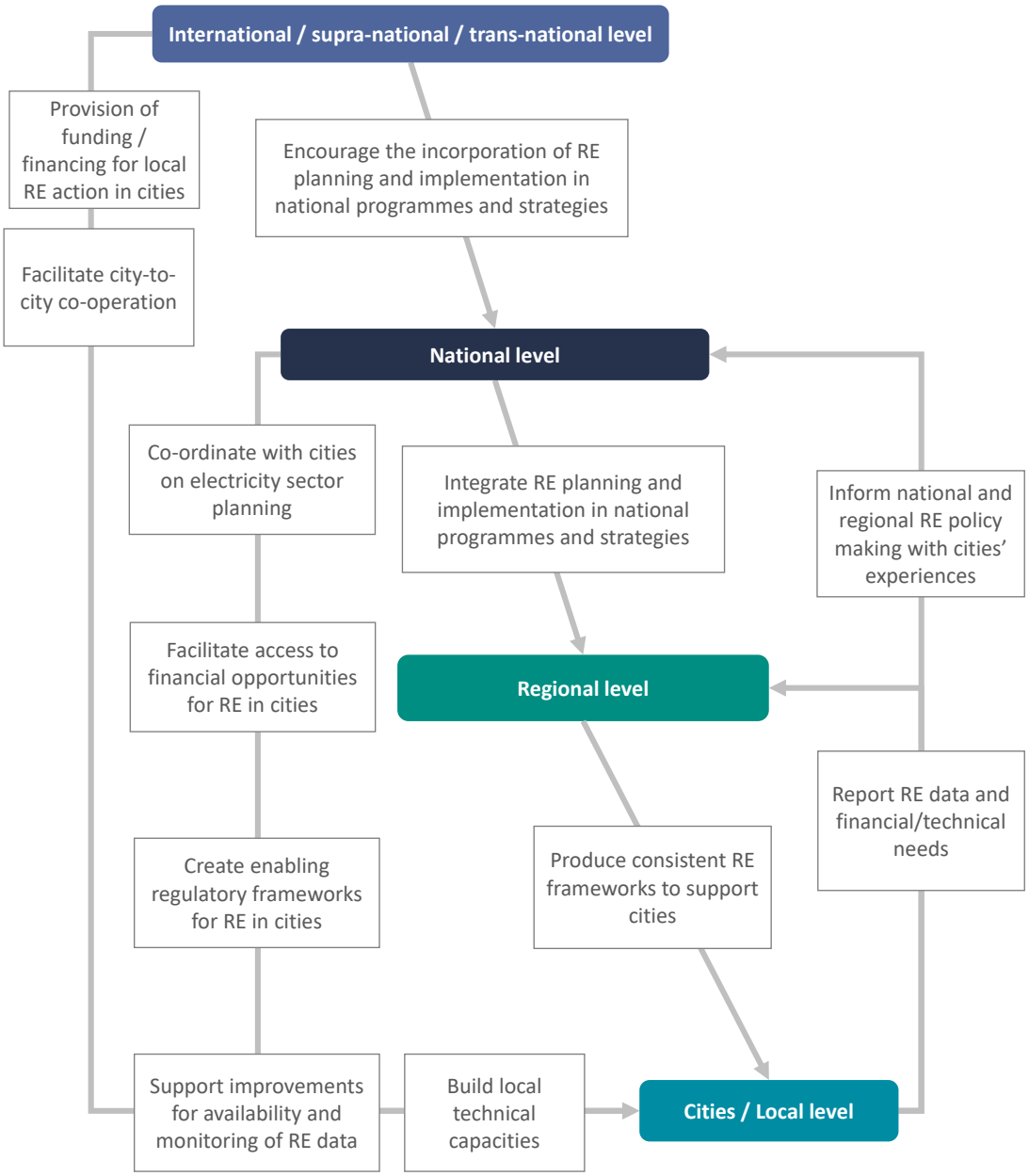
was then used by Zhangjiakou's development and reform commission and state grid (Hebei Provincial Development and Reform Commission, 2018[43]). A Steering Committee led by a high-level official from NDRC, and with representatives from national and sub-national actors[8] supervised the project (National Development and Reform Commissiion, 2021[44]) (IRENA, 2019[45]), and supported by an expert advisory committee.[9]

Moreover, vertical co-ordination is required to align RE targets between the national and municipal governments, and also to improve knowledge and data sharing. National governments of regions without RE targets could also motivate municipal governments to set targets and provide them with the enabling conditions to achieve them (IRENA, 2020[46]). The provision of enabling conditions is a process that involves various elements, from e.g. regulatory changes to access to financing opportunities (discussed in the next sub-sections). Depending on the local circumstances, this process might take time to set up, and vertical co-ordination could help speed up decisions by facilitating enhanced communication among actors at different levels of government. Figure 3.1 outlines an illustrative example of vertical co-ordination for RE projects involving cities.

[8] E.g. China's Ministry of Science and Technology (MOST) and NEA, Hebei Province's development and reform commissions, and the municipality government of Zhangjiakou.

[9] In 2017 NDRC established an expert advisory committee for Zhangjiakou RE demonstration zone in co-ordination with other Ministries (Including MOST, Ministry of Finance, and the former Ministry of Land and Resources (new Ministry of Natural Resource from 2018) and national state agencies (such as NEA and Chinese Academy of Science) local government of Beijing, Tianjin, Hebei province and Zhangjiakou, and State Grid Corporation. Members of the committee included experts from academia, industry, state and local government agencies and international organisations (National Development and Reform Commission, 2017[154]).

Figure 3.1. Example of vertical co-ordination on RE projects



Source: Authors, based on (JRC, 2018[47]).

3.2.2. Clarifying responsibilities and devolving powers can also increase RE implementation

Clarity from national authorities on which levels of government are responsible for which elements of RE implementation and scale-up has helped to facilitate an uptake of RE projects in cities (REN21, 2021[32]). While national governments are best suited to lead certain aspects of RE planning, implementation and scale up in cities, other aspects would be best managed by municipal governments. These aspects could include setting a city-wide vision and plan, establishing local norms and regulations, and undertaking advocacy and knowledge-sharing (Coalition for Urban Transitions, 2020[37]). Responsibilities and devolution of powers need to be set by national governments in line with the different elements of RE

planning and implementation, which include infrastructure, regulation and governance (Coalition for Urban Transitions, 2021[38]). For instance, in Germany the distribution of competences across these elements for RE projects implementation in cities has been clarified for different layers of government. The Federal Government sets the renewable energy incentive policies at the national level. The regional states (Länder) promote RE implementation through building regulations, land-use planning and regulations, and other local government regulations (i.e. guidelines for municipalities). The municipal governments are in charge of finding the location for RE projects (Climate Chance, 2021[48]).

Cross-government collaboration is another important aspect when clarifying responsibilities across various levels of government relating to RE deployment in cities. For instance, in China the governance of the energy sector development remains relatively centralised, but certain aspects of RE implementation are managed by local governments. At national level, China's Five-Year Plans are a series of social and economic development initiatives, with the most recent (14th Five-Year Plan 2021-2025) covering topics ranging from the economy, environment and energy to transport, R&D and urbanisation. As part of this Five-Year Plan, the national renewable electricity feed-in tariffs (FiTs) policy[10] has been tiered according to regions with greater or lesser renewable potential. This effectively means that local governments are responsible for approving renewable generation facilities. For instance, distributed generation and household solar PVs are managed by municipal governments, and since 2015 provincial energy administrative departments can approve utility-scale projects and must approve transmission and connection lines for new plants above 6 MW. China also has a feed-in premiums (FiPs)[11] policy for solar PVs (household, industrial, commercial), but many cities add their own local FiPs for distributed solar, such as Beijing Municipality adding an extra premium per kWh generated by solar PVs for a five-year period (2015-2019). Such policies helped the Yangtze Delta region to become the region with the most distributed PV installations in China (WRI China, 2018[49]). The RE policies of Chinese cities are developed in the context of many provincial level policies. Cities decide on RE projects that receive FiT and FiP, and can decide on electricity tariffs. The ability of cities to adopt additional financial support measures will depend on their own financial resources and renewable resources, and in many cases requires support from national and provincial governments (IRENA, 2021[34]).

3.3. Addressing regulatory barriers

When municipal governments plan to develop RE projects or increase their use, this must be consistent with the broader legal framework, which can be set at a regional, national or in certain cases at supranational government levels. National governments can intervene where the national legal framework constrains or blocks the efforts made by cities to scale up renewable energy uptake. National governments can adopt legal and regulatory enabling measures for the implementation of RE projects and infrastructure, tailor national policies and regulations to support local RE delivery solutions in cities, and trial new enabling regulatory approaches – all areas explored in the next sub-sections.[12]

[10] FiTs are policy mechanisms whereby renewable energy generators are awarded long-term contracts through which they are paid a fixed price for the electricity produced and fed into the grid, irrespective of the wholesale electricity price.

[11] FiPs are policy mechanisms whereby renewable energy generators are paid a premium price in addition to the wholesale electricity price.

[12] Other possible approaches – not explored in this paper – include establishing data sharing frameworks to facilitate RE implementation (both on physical infrastructure and market data), and mapping out how other existing policies in other domains may be affected by and may affect RE projects developments in cities (Coalition for Urban Transitions, 2021[38]).

3.3.1. Allowing electricity procurement from independent power producers can foster RE

A national regulatory framework that enables cities to procure their electricity from independent power producers (IPPs), could enhance the implementation of RE projects in cities. Power purchase agreements between cities and IPPs are becoming more and more common in some countries, e.g. USA, Ghana, Nigeria, Egypt, Morocco, Cameroon and Fiji (IRENA, 2022[50]) (Roedl & Partner, 2016[51]) (ADB and REN21, 2019[52]). The experience of the city of Cape Town (South Africa) illustrates this. Until recently, the city procured its electricity, provided by the state monopoly Eskom, exclusively from the national grid, which is dominated by GHG-intensive coal-fired power plants and has recently suffered from a number of outages (C40, 2021[53]). In 2020, the municipal government set a goal to reach net-zero emissions by 2050, supported by a comprehensive action plan (City of Cape Town, 2020[54]). Cape Town has two options to decarbonise its electricity use, which are all needed to achieve the city's net zero goal (Coalition for Urban Transitions, 2020[37]). Firstly, the city could increase the direct purchases of RE electricity by the city-owned distribution system. Secondly, the city could increase the adoption of rooftop solar PVs. As part of this first route, the city of Cape Town is seeking to procure RE electricity from IPPs. However, South Africa's regulatory framework was unclear on whether a city can procure electricity from producers other than Eskom (C40, 2021[53]). Providing cities the right to source their electricity from IPPs could help them reduce their carbon footprint and incentive the uptake of RE in cities. Thus, the municipal government of Cape Town sought the right to source its electricity supply from IPPs, arguing that under the South African constitution a city has the duty to provide basic services including electricity, and should have the "authority to determine how best to discharge this duty" (C40, 2021[53]). After several legal and regulatory disputes between the city and the national government, in October 2020 the national government amended the country's electricity regulations to enable cities to develop their own electricity generation projects. The municipal government of Cape Town has also established a municipal-level Renewable Energy Independent Power Procurement Programme to procure RE electricity at scale, and is developing a guide on how to engage with industries in procuring energy from IPPs (REN21, 2021[32]). As a result of this regulatory change, in early 2022 other cities in South Africa, such as Ekurhuleni, have also started sourcing some renewable electricity from IPPs (News24, 2022[55]).

Non-payment by national utilities for the RE electricity generated by IPPs, however, could be an issue in certain countries. For instance, in Tanzania, many IPPs have suffered from late payments from the state-owned utility TANESCO (Bloomberg NEF, 2021[56]). This, combined with a lack of enforcement of a national law exempting imports of off-grid solar products from value-added tax (The United Republic of Tanzania, 2019[57]), mostly due to the unfamiliarity of tax officers with this national legislation (Bloomberg NEF, 2021[56]), have significantly slowed down the uptake of RE generation in the country. This represents a challenge for cities in the country, like Dar es Salaam, which rely mostly on grid-connected renewable resources for its decarbonisation objectives. However, this is not an isolated case. In India, for example, distribution companies have recorded delayed payments to IPPs (Ministry of Power of India, 2020[58]). National governments could support IPPs by e.g. working with utilities and distribution companies to address non-payment issues.

3.3.2. Net metering can increase the uptake of renewable electricity

By adopting certain utility sector regulations, such as "net metering", national governments can provide incentives for further uptake of RE electricity in cities. Net metering tariffs allow, for example, building owners to sell excess electricity from rooftop solar PVs to their local utility, providing added financial incentives for the adoption of RE technologies. If the rooftop solar PVs are connected to the grid, the excess electricity generated can be injected to the grid in exchange for credits, which can then be used to pay for grid electricity when the solar PV cannot meet electricity demand (e.g. at night time). In certain countries, such as India or the United Arab Emirates, national regulations to enable the net-metering

mechanism to function have not yet been set up. In such cases, municipal authorities can step in where legally permitted and enact regulations for net metering to function, as in the case of New Delhi and Bangalore (India) or Dubai (United Arab Emirates). Net metering was introduced in 2014 in New Delhi, where homeowners are given the choice to purchase the PVs or lease them from third-party project developers. In the same year, the city of Bangalore also introduced a net metering programme, allowing the deployment of rooftop PVs to expand rapidly among citizens, business owners, schools and other public institutions, with the capacity of solar connected to grid increasing from 5.6 MW to 98 MW between 2016 and 2018 (IRENA, 2021[34]). In Dubai, the introduction of net metering allowed the installation of 30-40 MW of solar PVs (IRENA, 2021[34]).

Allowing net metering in national regulations could also help densely populated cities overcome a common challenge – that of constrained urban space to install rooftop PVs because of, for instance, regulatory restrictions on heritage buildings, or a lack of suitable roof space. These barriers can often prevent city residents from installing solar PVs. To overcome this challenge, some national governments have created a legal framework enabling cities to adopt regulations facilitating the creation of community solar projects, generally on public soil (e.g. on rooftops of public buildings) within cities boundaries, sometimes outside densely populated areas.

Community solar projects entail the development of solar PVs through collective local ownership and decision-making powers, managed by local people for the benefit of local people. The implementation of community solar projects also brings important local co-benefits such as job creation, cost saving and price certainty[13], and enhanced awareness and public acceptance of renewable energy technology. This type of project is most common in countries that have liberalised energy markets and where incumbent energy providers have less control of the grid electricity mix (REN21, 2021[32]).

3.3.3. Tailoring national policies and regulations can support local RE delivery solutions

National governments could also support the implementation of solar PVs in cities by tailoring national building energy codes to support local RE delivery options. For instance, applying a "whole-building" energy performance approach as part of national building codes is one option to incorporate RE technologies in new buildings. This approach enables the implementation of a mix of energy conservation measures alongside the production of RE electricity on-site, e.g. through the installation of rooftop solar PVs.

In some countries, such as the US, the national government establishes general guidelines for national building energy codes, and the municipal governments can develop local standards that are informed by these guidelines. In other countries, building codes may be more prescriptive, but they might differentiate requirements depending on different characteristics of covered jurisdictions; e.g. requiring codes as part of mandatory sustainable energy plans for cities above a certain size (IEA, 2016[36]).

[13] For instance, (Berka and Creamer, 2017[156]) demonstrate how, in certain cases, local community solar projects "are able to sell electricity directly to their members at lower (wholesale) prices than (retail) prices from an alternative distribution network operator". This is possible especially when community solar projects can meet licensing requirements on electricity distribution and supply, which can often happen through private wires, or in partnership with commercial organisations (Berka and Creamer, 2017[156]).

3.3.4. Revising existing or piloting new regulatory approaches can enable further RE uptake

Governments at the competent level and with the authority to do so, could revise electricity regulatory frameworks where these discriminate against RE generation or procurement in cities. This could happen for instance if the price of electricity generated by RE is distorted for a certain segment of the population, such as customers who are purchasing primarily RE electricity. In 2018, two utilities providing electricity to Kansas City (USA) requested their state energy regulator for a rate increase for customers with solar PVs, because the applied rates were too low for them to recover their fixed costs. After various legal appeals, the Kansan Supreme Court deliberated that this price increase “constituted price discrimination" because it would inflate the electricity bill of residential solar customers (C40, 2021[53]).

Proactively reviewing existing policy frameworks in specific areas where barriers to mitigation activities have been identified could be a more effective and efficient way forward than litigation. However, in order to prompt policy review, some cities have taken legal action against national governments, including for the development or procurement of urban RE (for some examples, see (Columbia University, 2022[59]; C40, 2021[53])). Experience has shown that if cities initiate litigation against the national governments the process to get to the legislation reviewed could be considerably longer and more expensive than if the national governments proactively sought to review the legislation (C40, 2022[60]).

Moreover, national governments could also work with cities to pilot new enabling regulatory approaches that could support the development of further RE systems. For instance, the city of London (UK) has benefited from a national enabling regulatory framework set up by the UK’s national electricity regulatory body that allowed it to trial peer-to-peer electricity trading[14] among companies (Ofgem, 2018[61]) (Coalition for Urban Transitions, 2020[37]). This experience has allowed the city of London to develop a significant local knowledge base for further development of decentralised RE electricity markets. New enabling regulatory approaches could also help address new challenges related to the integration of variable urban RE sources in national grids, the development of electricity storage systems in cities, and the aggregation of services from distributed renewable energy systems in cities. However, these are areas where there is yet little experience from a regulatory perspective and will require a learning curve from regulators at national and municipal government levels. Cities can make use of enabling national regulatory frameworks to experiment with new regulatory and market structures as a way to inform national strategies and plans.

3.4. Addressing technical issues

National governments could support cities overcome a number of different technical issues related to implementing RE projects or increasing the use of RE. Technical issues for the planning and implementation of RE projects relate i.a. to data availability and quality, monitoring for urban energy system planning, and how to manage grid flexibility.

3.4.1. Disaggregated data is essential for effective RE planning and development

National and municipal governments can each play important roles in ensuring availability of good quality data and the affordability of the data monitoring systems. The planning process for urban and national

[14] Peer-to-peer electricity trading platforms, such as the one trialled in London, “facilitate energy trading between individual businesses or prosumers” (domestic or commercial consumers who have energy generation or storage facilities), at local levels (Ofgem, 2019[157]).

energy systems rely on data that feed into the national GHG inventory and urban energy modelling tools.[15] More granular data are needed for urban energy systems planning compared to larger-scale (e.g. national-scale) models. Monitoring and collecting these data with the level of spatial and temporal granularity required could be challenging, not only because of the associated human and financial resource needs for certain monitoring (generally, the more granular information, the more costly the monitoring system), but in some cases also due to confidentiality issues (e.g. when private operators do not want to disclose sensitive data). The key datasets needed for urban energy system planning relate to data on energy demand, supply, costs, urban infrastructure, energy technology, microclimate and weather (IRENA, 2020[46]). Considering the focus of this paper, a non-comprehensive overview of supply, urban infrastructure and energy technology data is provided below.

Table 3.1. Non-exhaustive examples of supply, infrastructure and technology data requirements for urban RE system planning

Category	Parameter	Details / comments
Energy supply data	Electricity supply mix	Share of RE and non-RE electricity sources in the grid mix
	Electricity generation data by zoning sector and end-use application	The frequency of data collection varies per RE technology, i.e. hourly for solar and wind; seasonally for hydropower; annually for biomass and waste
	Installed capacity / capacity potential	-
	Generation potential	
	Technology efficiency	-
	Availability factor (for decentralised RE)	This can vary widely with location, time of the day, season.
	Storage solutions	-
	Peak supply technologies	-
	Reserve capacities	-
Urban infrastructure	For siting solar PVs: Rooftop / façade installation potentials, shading by surrounding buildings, trees and other infrastructure, building zoning restrictions	E.g. rapid skyline changes, as often occur in cities in developing countries, could alter the potential generation of rooftop solar PVs, hence representing a risk for long-term investments.
	Network layouts of electricity distribution grids	-
	Electricity transport networks	-
	Electricity network losses	-
	Technology lifetime data	E.g. how long a specific technology is expected to last
	Spatial information (geographic information system, or GIS)	GIS could be used to map urban renewable energy potential. Cities could use data analytics to understand how changes in urban development could potentially affect this potential.
Energy technology data	Costs	E.g. current and estimated investment, operation and maintenance, disposal costs – which can vary widely with location.
	Performance factors	E.g. current and estimated technology efficiency, availability factor, losses

Note: GIS = Geographic Information System.
Source: Authors, adapted from (IRENA, 2020[46]).

The main challenges related to the collection of these data relate to data resolution and data availability, and in certain cases national governments could help cities overcome these challenges. Data resolution challenges occur when high spatial and temporal resolution is required to inform urban energy system planning or to feed the national GHG inventory. These data are often lacking, but several methods could

[15] (IRENA, 2020[46]) provides a comprehensive overview of the wide-range of modelling tools for urban energy systems planning.

be employed to overcome this problem. One is methodological, e.g. applying disaggregation / aggregation methods[16] to estimate data gaps. Another potential solution entails the deployment of enhanced digitalisation monitoring devices, such as smart meters or sensors at the power-plant level. National governments could encourage the collection of disaggregated data on RE activity and potential, and could incentivise the uptake of digital monitoring technologies in cities through financial incentives and regulations.

Data availability may also be constrained because of a lack of monitoring systems. At the moment, data on RE electricity potential in urban areas has rarely been collected (IRENA, 2020[46]). In most countries, the national government has an energy statistics agency or office established at the national level, but not at the city level. Where capacities and resources are available, if national governments encouraged (e.g. through regulations and provision of associated resources) the establishment of energy statistics agencies at the city-level, this could help increase the availability and quality of urban RE electricity data. Moreover, even if data are collected at urban level, it would be important to have harmonised formats to ensure good quality and reporting, allowing comparison and aggregation of data which are key for national GHG inventories reporting. National governments could help by providing harmonised formats to collect and report urban RE electricity systems data.

3.4.2. Adopting urban technical solutions could increase the stability of the grid

Co-ordination between city and national governments is essential to integrate urban, grid-connected variable RE projects (such as wind or solar power) in the national grid. National governments have different options to develop flexible grid management systems, and invest in electricity storage capacity and in more adapted transmission and distribution electricity lines. A higher electrification of urban activities, including transport and heat, leads to higher and more frequent peaks in electricity demand, and could also bring higher volatility if the RE sources used to satisfy the increased demand are variable. In certain cases, the decentralisation of energy supply through RE sources could be a practical solution to reduce the potential increase of volatility of the grid. For instance, rather than investing in costly grid infrastructure extensions in low density urban areas, national governments could promote the use of decentralised, non-grid connected solar PVs as a lower-cost alternative to providing universal energy access.

Another option to increase the stability of the grid is for national governments to support the development of storage solutions for grid-connected variable RE electricity produced in cities. The implementation of storage solutions for RE electricity in cities can be promoted, financed and developed in many ways, e.g. by private companies, utilities, or other stakeholders. Cities could also play an active role in certain cases, and there are examples of how cities have invested in storage technology to meet peak demand. For instance, in 2017 the city of Adelaide (Australia) implemented a large-scale storage solution that can dispatch electricity during peak demand. This storage solution, called “Hornsdale power reserve”, is a large battery that plays an important role for the stability of the grid (Hornsdale Power Reserve, 2022[62]).

[16] Disaggregation methods allow to scale down data, and include e.g. estimating hourly electricity demand starting from the annual electricity demand data or aggregated other statistics. Aggregation methods function in the exact opposite way – i.e. by extrapolating the aggregate level from a few datapoints.

3.5. Addressing other issues

3.5.1. National governments can provide financial incentives and facilitate access to finance for NPS

A common challenge that cities face when planning the implementation of RE electricity generation projects is access to financing, mobilising revenues and allocating budgets. National governments could deploy several options to help cities to overcome these barriers. The IFC estimated that the investment potential for renewable energy in cities to 2030 is USD 842 billion, with the largest potential in East Asia Pacific and Latin American & Caribbean cities (IFC, 2018[63]). Nonetheless, RE projects generally face inherent financing challenges related to high upfront costs. Even a prefeasibility study could be a significant expense for municipal governments, as this could represent over 10% of the total project costs (REN21, 2021[32]). Municipal governments often face budgetary constraints and have to attend to multiple competing claims on their limited financial resources, depending on local priorities. Some cities, especially those located in developing countries, may also face additional financial barriers, such as a lack of a sufficient tax base to raise adequate financing and low levels of creditworthiness[17] (REN21, 2021[32]), which is a critical criterion for accessing finance.

One option for national governments to help cities overcome these challenges is to provide NPS with financial incentives to encourage the purchase and installation of RE systems in cities. These include fiscal measures (e.g. tax rebates, reduced tax rates), direct funding (e.g. earmarked revenue from carbon taxes, see (Ministry of the Environment, 2017[64])), grants or loan guarantees for private developers and local governments. These incentives could also be targeted directly to citizens. For instance, the Property Assessed Clean Energy (PACE) programme in the United States is an innovative financing mechanism implemented jointly by State and Federal governments for energy efficiency and RE investments in commercial and residential properties, and has been useful in expanding the adoption of rooftop solar PV systems in the country. The mechanism allows the property owner to implement RE electricity projects without a large up-front payment, which is covered by the PACE programme. The property owner then repays these costs over time (around 10-20 years) through property assessments, which are secured by the property itself and paid as an addition to the owners' property tax bills (US Office of Energy Efficiency & Renewable Energy, 2022[65]). One innovative component is that the debt of the PACE programme is tied to the property, and not to the property owner. This means that the repayment obligation is transferred to the new buyer if the property is sold. In providing such financial or fiscal incentives, national governments would have to consider potential implementation challenges, such as budgetary commitments, administrative burdens and the need for technical capacities (Broekhoff, Piggot and Erickson, 2018[66]), as well as the capacity of cities to administer and spend the received funds.

Addressing economic and social equity concerns when implementing financial and fiscal instruments is also an important aspect to consider. For instance, the specific design of a policy impacts its distributional effects: if the national government decides to implement feed-in tariffs for distributed renewables, these could turn out to be regressive, i.e. they increase costs for all electricity consumers, but would only benefit those citizens that can afford to install RE projects. Hundreds of low-income homeowners in California who joined the PACE programme (above) now face steep property tax debt and risk home foreclosure. This is mostly due to an implementation flaw of the programme, whereby these homeowners – mostly low-income households - accepted indebtedness through PACE based on misleading data and information on the cost-effectiveness of the PVs that home contractors installed on their rooftops (Berkeley Law, 2021[67]). Introducing an independent, third-party environmental verification of the performance standard of the PVs installed (Berkeley Law, 2021[67]) could overcome such flaws in future.

[17] Less than 4% of the 500 largest cities in developing countries are deemed creditworthy in international capital markets (REN21, 2021[32]).

It would be then important for governments to understand the social implication of their RE incentive policies and the broader context in which they are administered, and design the policies to take social impacts into account.

National governments could also help sub-national governments, including cities, access finance for the development of RE projects. The borrowing power of municipal governments may be limited by national legislation, low levels of creditworthiness and/or small urban population size. This can restrict the options of financial instruments that cities have through the creation of debt, such as the issuance of bonds[18] (REN21, 2021[32]). In these cases, accessing other financial opportunities other than issuing bonds is of utmost importance for cities that want to develop or procure RE electricity. Such financing opportunities could be available for instance through international financial institutions (e.g. World Bank, IMF, African Development Bank, Asian Development Bank, etc.), e.g. in the form of development finance. However, cities do not typically have direct access to these institutions. Therefore, for municipal governments to access financing opportunities from international financial institutions could require close co-ordination across a wide range of stakeholders (including at national government level) (REN21, 2021[32]). Both concessional and non-concessional finance could potentially be available, depending on the country. An example includes the Green Climate Fund (GCF)-supported Green Cities Programme, which is implemented via the European Bank for Reconstruction and Development (EBRD) (EBRD, 2019[68]). This project was started in 2019 and significantly expanded in 2021 (EBRD, 2021[69]). The national governments of the countries participating in this project are eligible to receive support, which is then passed onto cities in the form of grants and concessional loans for investments in sustainable infrastructure (including RE projects), technical support and capacity building, and roadmaps for cities to access green finance. As of February 2022, the programme supported 52 cities, including the city of Gaziantep (Turkey) for the development of five solar PV systems with 27 MW installed to power municipal building and services (EBRD, 2021[70]).

Municipal governments can also take initiatives to attract investments in RE projects, which requires co-ordination among different actors at local and national level. For instance, the Municipal council of Kasese (Uganda), which faces financial access limitations, established a “one-stop centre that brings together the government, the private sector, and NGOs to showcase opportunities/services they offer to boost renewable energy financing to local communities” (IRENA, 2021[34]). Thanks to this initiative, banks, the Uganda Revenue Authority, the Micro Finance Support Centre and Savings and Credit-Cooperative Organisations started participating in RE projects in the city. Moreover, the city also allocated land to investors interested in developing solar PVs plants. Furthermore, the city also participated in the Solar Loan Programme run by the Uganda Energy Credit Capitalisation Company (UECCC), aimed at facilitating investments and providing credit support for renewable energy projects in Uganda. As part of UECCC, a short-term solar loan product was developed to support micro-finance institutions, commercial banks and other credit institutions licenced by the Bank of Uganda to facilitate the acquisition and installation of solar home systems by households and business and to overcome high upfront costs.

National governments could also facilitate the establishment by cities of public-private partnerships (PPPs) to leverage funds from external partners for RE projects. PPPs could represent an alternative means of financing RE projects in cities, while shifting performance and technology risks to the private sector. Generally, PPPs are funded by public sources (national or regional) as well as from companies. Different PPPs models exist: build-operate transfer, build-own-operate, design-build-operate and lease-develop-operate (UNCTAD, 2013[71]). For instance, the city of Vadodara, in the Indian state of Gujarat, implemented a PPP on a build-own-operate model, whereby the selected private developer was responsible for identifying the right locations and installing solar PVs on public and private rooftops for an

[18] Many cities already used municipal bonds to finance RE projects, including: Johannesburg (South Africa), Tokyo (Japan), Paris (France), Gothenburg, Lund, Malmoe, Nacka, Norrkoeping, Oerbro, Oestersund, Vasteras, Vellinge (Sweden), Toronto (Canada), Auburn, Honolulu, Otis, Richland, San Francisco Spokane (USA) (REN21, 2021).

aggregate capacity of 5 MW. Under this agreement, the building owners receive a rental income for the space used to install the solar PVs, while the private developer connected the PVs to the grid to sell the electricity generated to the local distribution utility. The support of the government of the Indian state of Gujarat was instrumental in convening different key actors to implement the project, including the project developers, the local utility, and international finance institutions (in this case, the International Finance Corporation, which provided transactional advice and credibility to attract private financing) (IFC, 2015[72]). In particular, the Gujarat government facilitated agreements with power procurers for the electricity generated, guaranteed a subsidy to the operators, and provided access to public buildings for solar PVs installation (IFC, 2013[73]).

National governments could support cities by creating a regulatory environment and power market structure that allow cities to pursue power purchase agreements (PPAs). Cities could also use PPAs to procure RE electricity for their own electricity needs. PPAs – in the context of RE procurement - are long-term contracts whereby buyers agree to purchase the RE electricity for a fixed price during a certain period (usually 10-25 years). Sellers of electricity under a PPAs could be IPPs or utilities connected to the grid. Municipal governments may initiate projects e.g. by committing to buy electricity from a specific RE project, which guarantees a steady income for the RE project developers, helping them secure project financing. This is a way for cities to leverage private financing for RE projects. If a city has sufficient electricity demand, the municipal government could consider signing a bilateral PPA with a RE generator. This is the case of Washington DC (USA), which in 2015 signed a PPA with a wind RE project developer, covering 30-35% of the municipal government's electricity needs and saving USD 45 M over 20 years of contract (C40, 2022[74]). If a city does not have sufficient electricity demand, another option could be to aggregate the buying power of several stakeholders to achieve economy of scale and to be more attractive to RE project developers. These "collective" PPAs are signed between the project developer and the municipality and its partners (could be public or private institutions). For instance, the city of Melbourne created a collective PPA, the Melbourne Renewable Energy Project, whereby 14 public and private institutions (including local councils, universities and banks) committed to purchase 88 GWh of wind electricity per year from a wind farm that was built deliberately to satisfy this collective demand (City of Melbourne, 2022[75]). Sometimes local regulations and power market structures can prevent cities from pursuing PPAs, e.g. when the city can purchase electricity only from the existing utility. In these cases, virtual PPAs are possible – i.e. "the renewable electricity generated by the project is bought and sold into a power market that may or may not be the same as the customers" (REN21, 2021).

3.5.2. Local technical capacities are needed to implement urban RE projects

Often, municipal governments do not have sufficient technical expertise to plan and implement RE projects or systems, or the ability to retain such expertise; national governments could assist cities by building technical capacity directly or directing to sources of technical assistance. National entities, such as planning or energy ministries, national energy agencies or the national regulator, could initiate efforts to engage through technical assistance with municipal governments on electricity planning.

For instance, the European City Facility programme, funded by the European Union, provides technical capacity building to selected, beneficiary municipal staff to develop sustainable projects in cities (including local RE electricity projects), alongside financial support (European City Facility, 2021[76]). This programme aims at providing municipal staff the tools, networking and knowledge transfer opportunities to facilitate project implementation, including for RE. In particular, it can provide technical expertise to develop the investment concept of an urban RE project. The capacity building support is structured to involve several layers of government. Selected country experts can then assist the beneficiary municipal staff to develop their RE investment concept. As of February 2022, the programme has gone through three calls for applications, and has supported projects in several small, medium and large size European cities (European City Facility, 2022[77]). For example, the programme helped the city of Cascais (Portugal) to perform a market analysis, the creation of a "One-Stop-Shop" and an economic analysis of the

investment required for the development of a new, 184 MW community-based solar project (European City Facility, 2020[78]). In this case, the role of the national government was instrumental, as it introduced a new national legal framework to promote the creation of local energy communities that facilitated the planning of the solar PV project in Cascais (European City Facility, 2020[78]).

4. Deep dive: scaling up actions aimed at reducing deforestation and forest degradation by non-Party stakeholders

Non-Party stakeholders (NPS) play a key role in the implementation of REDD+ activities. REDD+ stands for "Reducing Emissions from Deforestation and forest Degradation, plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks". REDD+ is a framework developed under the United Nations Framework Convention on Climate Change (UNFCCC) that regulates activities that prevent elimination or degradation of forests in developing countries. It was agreed on at the 16th Conference of the Parties to the UNFCCC (COP) in Cancun and is governed by the Warsaw Framework for REDD+ adopted at COP19.

This section explores measures that national governments can take to facilitate the implementation of REDD+ initiatives by NPS. First, this section briefly discusses the mitigation potential of REDD+, the roles of different actors in and challenges to REDD+ implementation, as well as the measures that national governments can take to tackle these challenges. Second, the section collects concrete experiences of how measures taken by national governments have contributed to tackling challenges to REDD+ implementation across the world. The section focuses on experiences in dealing with institutional, technical and regulatory challenges, as well as challenges relating to increasing the financial attractiveness of REDD+ activities. Drawing on these experiences, the section identifies lessons for national governments on how they can facilitate NPS action within the framework of REDD+ initiatives.

4.1. Implementing REDD+ activities by NPS: Context and challenges

4.1.1. Mitigation potential

Annual global deforestation emissions have been rising since 2010 (WRI, 2022[79]) and need to be sharply reduced to be aligned with the Paris Agreement (UNFCCC, 2021[5]). Actions aimed at reducing deforestation and forest degradation have considerable GHG mitigation potential – particularly in tropical countries.[19] According to the IPCC, decreasing deforestation and forest degradation has the greatest potential to reduce emissions in the agriculture, forestry and other land use (AFOLU) sector, which is responsible for almost a quarter (23%) of total net anthropogenic emissions (Shukla et al., 2019[80]). Graham (2016[81]) reports that avoiding tropical deforestation has a mitigation potential of up to 20% of total annual emissions.

REDD+ can play an important role in the protection of tropical forests by providing financial incentives to countries or sub-national actors to implement activities aimed at reducing deforestation and forest degradation. REDD+ projects are located in countries where the largest tropical forests can be found –

[19] The vast majority of global deforestation since 2001 has occurred in tropical regions (WRI, 2022[77]).

i.e. in the Amazon River Basin, the Congo River Basin and throughout Southeast Asia (Malhi et al., 2013[82]).

4.1.2. Roles of Parties and NPS in REDD+

Implementation of REDD+ activities can take place at different scales and can involve both national governments and NPS. Under REDD+, national governments can implement country-wide jurisdictional approaches or can co-ordinate with NPS that implement jurisdictional approaches (sub-national authorities) or project-based activities (corporates and NGOs). Boyd et al. (2018, p. 2[83]) define the jurisdictional approach to REDD+ as "a government-led, comprehensive approach to forest and land use across one or more legally defined territories". Jurisdictional REDD+ thus refers to programmes developed across one or more physical jurisdictions and led by the corresponding political authorities. The scale of the jurisdiction can span from the national level to different sub-national levels as applicable (e.g. States, provinces, districts, cities). Jurisdictional programmes provide an opportunity to align policies and co-ordinate the strategies of a wide range of stakeholders. Project-based REDD+ activities are usually led by private actors or NGOs and have been traditionally developed on the voluntary carbon market (Duchelle et al., 2018[84]). Project-level activities have narrower boundaries than jurisdictional programmes and although they can move faster than jurisdictional programmes, they do not have the same transformational power. Co-ordination of separate project-level activities under a national framework can help unlock the transformational potential of such activities.

Countries and NPS have different roles in the implementation of REDD+ activities. The guidance that emerged from the Cancun Agreements places the focus of implementation on the national level (UNFCCC, 2011[85]). National governments therefore have important responsibilities for creating a national policy framework for REDD+ implementation.[20] They are also responsible for reporting to the UNFCCC on the implementation of REDD+ activities in the country (UNFCCC, 2022[86]). Sub-national governments at different levels may lead jurisdictional REDD+ programmes. They can also support national governments with measurement, reporting and verification (MRV) of REDD+ initiatives within their jurisdiction. Private companies and NGOs are involved in the development of project-level activities and co-ordinate with governments to ensure that their project activities are integrated into national MRV systems. Private companies often develop projects that generate credits on the voluntary carbon market, while NGOs usually lead the practical implementation of project activities, liaise with and build capacity of local stakeholders. Finally, communities that own or reside in the land targeted by REDD+ initiatives are key actors in the implementation, as the degree of their involvement and buy-in of the initiative will determine its effectiveness. These communities often comprise Indigenous peoples, who possess important traditional knowledge of forests and contribute to their protection.

4.1.3. Common challenges and what national governments can do to help

REDD+ implementation at the sub-national level can face a variety of challenges. They encompass institutional, technical and regulatory challenges, as well as challenges relating to increasing the financial attractiveness of REDD+ activities. Institutional challenges to REDD+ implementation include e.g. lack of co-ordination and alignment between REDD+ processes at different government levels. Lack of institutional co-ordination can result, for example, in emission leakage across sub-national jurisdictions (Korhonen-Kurki et al., 2012[87]). Technical challenges emerge when stakeholders (both governmental

[20] The UNFCCC requests national government intending to implement REDD+ initiatives to have in place the following elements: a) a national strategy or action plan; b) a national forest reference emission level and/or forest reference level; c) a national forest monitoring system; d) a system for providing information on how REDD+ safeguards are being addressed and respected; e) a system to measure, report and verify REDD+ activities and resulting emissions. (UNFCCC, 2022[130]).

and non-governmental) lack the technical capacities needed to implement REDD+ activities. These capacities include developing and implementing MRV systems for REDD+ activities (World Bank, 2021[88]). Regulatory challenges are linked to the legal framework that underpins REDD+ implementation (see section 4.3.2) and notably include key challenges related to land tenure issues (Sunderlin et al., 2014[89]). Finally, REDD+ activities face the challenge of providing attractive financial alternatives to competing, business-as-usual (BAU) economic interests or livelihood systems that increase deforestation or forest degradation, as well as of redistributing financial benefits ensuing from the activities among stakeholders.

National governments can adopt three different types of measures to facilitate the implementation of REDD+ initiatives at the sub-national level: enabling measures, incentives and disincentives (Börner et al., 2018[90]; Kissinger, Herold and De Sy, 2012[91]). Enabling measures aim to create a favourable environment for the implementation of REDD+ initiatives. Such measures may include clarifying land ownership and access rights, as well as strengthening the capacity of sub-national stakeholders to take part in REDD+.

National governments can also use incentives (either monetary or non-monetary) or disincentives to influence changes in forest-harmful behaviour of different stakeholders (Simonet et al., 2018[92]). For example, Payments for Ecosystem Services (PES) are direct financial incentives, given to individuals or communities, conditional on the voluntary adoption of agreed natural resource management practices that enhance the provision of ecosystem services (OECD, 2010[93]; OECD, 2021[94]). National governments can use PES to encourage forest management practices that do not result in forest loss. Finally, disincentives are "the most common strategy […] to discourage deforestation and forest degradation" (Börner et al., 2018, p. 108[90]). Examples of disincentives include moratoria, fees, forest-use restrictions and their enforcement, or the creation of protected areas. Table 4.1 identifies some selected examples of measures that national governments can take to facilitate the implementation of REDD+ initiatives and, in turn, facilitate NPS action that underlies the initiatives. These examples are further elaborated in the following sub-section based on concrete experiences of how measures taken by national governments have contributed to tackling common issues with REDD+ implementation.

Table 4.1. Examples of measures that national governments can adopt to facilitate the implementation of REDD+ initiatives at the sub-national level

Measure type	Examples of measures	Type of issue being addressed
Enabling measures	Facilitate subnational access to data from satellite monitoring for MRV purposes	Technical issue
	Favour vertical co-ordination and alignment of REDD+ processes at different levels	Institutional issue
	Enhance land tenure security	Regulatory issue
	Enhance cross-sectoral policy alignment	Regulatory issue
Incentives	Provide performance-based monetary incentives for forest protection (i.e. PES)	Changing risk/reward profile of low-GHG activities
	Ensure that project benefits (monetary and non-monetary) are shared equitably among stakeholders through the adoption and implementation of a BSM	Changing risk/reward profile of low-GHG activities
Disincentives	Enforce forest protection regulations via monitoring and fines	Regulatory issue

Note: The measures have been selected based on the experiences of national government action collected in this section of the paper. As such, the list is not exhaustive.
Source: Authors.

The following sub-section identifies measures taken by national governments that have contributed to tackling common issues with the implementation of REDD+ initiatives at the sub-national level. The REDD+ initiatives identified in this section are being implemented primarily in Latin America and in South-

East Asia[21]. In particular, most of the examples collected in this section are drawn from Brazil and Indonesia. The importance of these two countries for future mitigation efforts within the forestry sector is paramount, as they are amongst the countries with the highest emissions linked to deforestation. Together, they accounted for 40% of total tropical forest loss in 2010-2014 and for half of emissions due to tropical deforestation associated with the expansion of agriculture and forest plantations over the same period (Pendrill et al., 2019[95]). Furthermore, Brazil and Indonesia are the two countries with the highest projected emissions from deforestation from 2020 to 2050 under a BAU scenario[22] (Busch and Amarjargal, 2020[96]).

4.2. Addressing institutional issues: vertical co-ordination and alignment can maximise efficiency and effectiveness

REDD+ implementation can greatly benefit from co-ordination between national governments and sub-national entities that are involved in REDD+ processes, as lack of information exchange between these two levels can result in efficiency losses or mismanagement of emissions leakage. The Cancun agreements emphasise the importance of a national approach (UNFCCC, 2011[85]), which allows for harmonisation of the process across the whole national jurisdiction. At the same time, implementation of REDD+ activities takes place at the sub-national level, involving sub-national governments as well as local NPS. Strengthening the exchange of information between national and local levels can increase the effectiveness of REDD+ initiatives, for example by enabling better management of emission leakage or ensuring accountable measurement, reporting and verification (MRV) (Korhonen-Kurki et al., 2012[87]). Indeed, formal vertical collaboration between different level of governments (as well as with the private sector) has shown promise in Indonesia (Environmental Defense Fund and Forest Trends, n.d.[97]).

Linkages between national and sub-national REDD+ processes can be institutionalised through the creation of entities or committees that bring together actors from both levels. These entities allow for an exchange of information and can facilitate the alignment of policy processes between the national and sub-national level. National governments could actively seek to have a presence in such committees when they are created by sub-national governments or REDD+ implementers, or mandate their creation as part of sub-national REDD+ processes. For example, in Chiapas (Mexico), linkages between national and sub-national REDD+ processes have been institutionalised through the state REDD+ advisory body – the Technical Advisory Committee for REDD+ (CTC-REDD+, Spanish acronym), which reunites experts from governmental and civil society institutions. Mexico's federal National Forestry Commission (CONAFOR, Spanish acronym) is a member of the Committee (EPRI, 2012[98]). Moreover, in Mexico, state CTC-REDD+ are connected to the national CTC-REDD+ through the submission of progress reports by state committees for the national sessions, thus reinforcing information exchange between the federal and state levels.

NPS need capacity building on REDD+ (FCPF, 2013[99]; Mg et al., 2018[100]; Ekawati et al., 2019[101]) and could benefit from support by national governments when these have already developed capacities related to REDD+. The case of Pastaza (Ecuador) demonstrates that support from national governments and linkages to national REDD+ processes can help build technical capacity at the sub-national level and develop more innovative REDD+ approaches. Pastaza was the first Ecuadorian sub-national government

[21] The geographical focus was adopted based on availability of information in the literature on jurisdictional approaches to REDD+. While Latin America and South-East Asia have been the target of extensive research, information on programmes that are implemented in other regions of the world is scarcer.

[22] From 2020 to 2050 and under a business-as-usual scenario, deforestation in Brazil and Indonesia would be responsible for the emission of 88.78 Gt CO_2, accounting for 38% of cumulative emissions from deforestation in the 30 tropical countries with the highest projected emissions from deforestation.

to prepare a REDD+ implementation plan in the country as mandated by the national REDD+ strategy (UNDP, 2021[102]). As such, the national government provided support to the sub-national government and civil society actors. Building on years of experience with REDD+, the national government passed its knowledge on to Pastaza's public officials which helped them to devise "one of the most innovative models" for developing or revising jurisdictional REDD+ and low-emission development strategies and investment plans (UNDP, 2021, p. 12[102]).

Official endorsement for sub-national REDD+ initiatives given by national governments within the framework of national REDD+ processes can help generate interest in the initiatives and, in turn, advance their implementation. This has been the case of the Berau Forest Carbon Program (BFCP), a jurisdictional REDD+ programme implemented in Berau District (East Kalimantan, Indonesia). BFCP is the recipient of financial support from several governments, civil society organisations and charitable institutions. In 2010, two years after the programme was initiated, the Government of Indonesia recognised BFCP as an official national REDD+ demonstration activity (Anandi et al., 2014[103]). Anandi et al. (2014[103]) report that this official recognition has contributed to helping the Berau Government and The Nature Conservancy (the implementer of the programme) to attract funding for the implementation of the BFCP.

4.3. Addressing regulatory issues

Regulatory issues faced by REDD+ include, among others, the ability to guarantee forest protection, as well as land tenure insecurity.[23] This section outlines how command-and-control measures used by national governments to enforce forest protection regulations can facilitate REDD+ implementation. This section also outlines what national governments can do to address tenure insecurity.

4.3.1. Establish a combination of incentives and disincentives

National governments can use command-and-control measures to enforce forest protection. These measures may include monitoring, fines, confiscation of equipment and embargoes on rural private properties with a view to discouraging forest conversion (Sousa, Vayda and Jokela, 2016[104]; International Partnership on Mitigation and MRV, 2018[105]).

Research suggests that command-and-control measures were effective at reducing deforestation, for instance, in Brazil (Trancoso, 2021[106]). The Brazilian Forest Code requires landholders in the Amazon to preserve between 50% and 80% of their land as forest. (Santiago, Caviglia-Harris and Pereira de Rezende, 2018[107]) For several decades, the Brazilian government took command-and-control measures to enforce the Code, including strong monitoring through police patrols and imposing environmental fines to non-compliant landholders (Duchelle et al., 2017[108]). Different studies argue that these measures were successful in reducing deforestation in the Amazon (Trancoso, 2021[106]; Assunção and Rocha, 2014[109]) as well as elsewhere (Persson et al., 2021[108]). In Mato Grosso, command-and-control measures such as the imposition of trade bans on products that come from illegally-deforested areas, fines and confiscation of means of production were also found to be effective to reduce deforestation (Sousa, Vayda and Jokela, 2016[104]).

[23] Land tenure security is defined by FAO (2002, p. 18[166]) as "the certainty that a person's rights to land will be recognized by others and protected in cases of specific challenges. People with insecure tenure face the risk that their rights to land will be threatened by competing claims, and even lost as a result of eviction." As such, land tenure insecurity can be understood as the lack of guarantee that a person's claim to land will be upheld because of absent or ill-defined formal land ownership, i.e. when ownership is not recognised by the authorities or when it is unclear because of multiple competing claims.

Potential negative impacts of command-and-control measures on forest-dependent communities can be mitigated through the use of incentives (Duchelle et al., 2017[108]). Providing incentives for forest protection, such as direct payments for stopping activities that result in forest clearing, may help partially offset the negative impact of disincentives (Börner, Marinho and Wunder, 2015[110]). A study by Duchelle et al. (2017[108]) covering 130 REDD+ villages across six tropical countries found that disincentives were successful in reducing deforestation, but they were associated with increased land tenure insecurity for and deteriorated well-being of local communities. However, the negative effects on communities were mitigated when disincentives were coupled with incentives such as technical assistance and inputs for the adoption of sustainable forestry and agriculture practices.

The importance of mixing incentives with disincentives can also be seen in Brazil's Sustainable Settlements in the Amazon project (PAS, Portuguese acronym), a REDD+ project that aims at reducing deforestation in the targeted area by providing landholders with a mix of incentives. These include technical and administrative support, cash incentives for forest preservation (i.e. PES) and education on environmental legal frameworks (Cromberg et al., 2014[111]). In parallel, participants were subject to the enforcement of forest restriction regulations and intensified monitoring activities by the national government. Using a combination of statistical models and remotely-sensed data, a study found that PAS had successfully halved deforestation rates among targeted landholders as opposed to areas not targeted by the projects (Simonet et al., 2018[112]). While it is difficult to precisely attribute PAS success to the different incentives and disincentives that landholders were provided with, it is possible that enforcement of forest regulations by the Brazilian government contributed to decreasing deforestation in the project area. More broadly, the study results suggest that mixing incentives, such as those provided by PAS, with disincentives, such as those provided by the Brazilian federal government, can represent a good strategy for reducing deforestation rates (Simonet et al., 2018[112]).

Engaging local communities in the enforcement of forest protection regulations can increase benefits for both authorities and communities (Nyamoga and Ngaga, 2016[113]). Using household-level data from five sub-national REDD+ sites in Indonesia, a study found that the enforcement of regulatory measures might have actually provided households with some benefits such as enabling better protection of land against competing external users (Duchelle et al., 2017[108]). The authors highlight that "this result makes sense in that […] several communities in Indonesia were involved in monitoring local landholdings" (Duchelle et al., 2017, p. 9[108]). In one of the projects analysed in the study – the BFCP – community involvement in monitoring had been encouraged by offering monetary and non-monetary benefits (e.g. cash, electricity) in exchange for these services. (Anandi et al., 2014[103]).

4.3.2. Addressing land tenure insecurity is key

Land tenure is a key issue for the implementation of REDD+, as the lack of secure tenure can hinder the development of REDD+ initiatives. Having clear property rights for land is a precondition for communities targeted by REDD+ initiatives to "participate in the decision-making process that establish rights and responsibilities associated with REDD+ activities and […] to benefit from REDD+ activities" (Sommerville, 2017, p. 2[114]). If forest land ownership is unclear or ill-defined, so is ownership over emission reductions resulting from REDD+ activities. This jeopardises smallholders' ability to receive the benefits brought by REDD+, such as cash payments. However, strengthened tenure security *per se* does not increase effectiveness of REDD+ initiatives, unless it is coupled with alternatives to economic activities that lead to deforestation for target communities. (Resosudarmo et al., 2014[115]).

Land tenure has been identified by some REDD+ project proponents as "the single most difficult challenge in establishing REDD+ on the ground when ranked against all challenges" (Sunderlin et al., 2018, p. 377[116]). In many developing countries, securing tenure rights in forest areas is challenging, as tenure of forest land in these countries is often based on customary rights that may not enjoy formal legal protection (World Bank, 2019[117]). Even when a community retains legal rights, it might not be able to

exercise them in practice if it lacks government support and effective control over the resources (Sunderlin, Larson and Cronkleton, 2009[118]). In 2016, only half of forests in developing countries had secure tenure (USAID, 2016[119]).

National governments play a prominent role in addressing land tenure insecurity. Sunderlin et al. (2014, p. 39[120]) affirm that "the source of forest tenure insecurity resides in country-wide historical patterns and processes that cannot be reduced to, or satisfactorily resolved at, the level of the locality." Actions to resolve tenure insecurity at the local level need to be complemented by national-level policies that aim at clarifying or securing smallholder rights over forests. At the same time, in a few countries, entities in charge of land might belong to sub-national administrative levels (Busch and Amarjargal, 2020[96])[24]. In this case, national governments may need to work closely with sub-national government entities or provide technical or financial support.

Research suggests that complementary national action is needed to bolster NPS efforts to address land tenure issues in areas targeted by REDD+ interventions (Sunderlin et al., 2018[116]; Sunderlin et al., 2014[120]; Larson et al., 2013[121]). An assessment of how REDD+ project proponents have tackled land tenure issues in five different countries found that although proponents have attempted to reduce land tenure insecurity within their project sites, "the best remedies […] cannot be the piecemeal efforts at tenure clarification within the bounds of the project, but instead require wholesale, landscape-wide reform" (Sunderlin et al., 2014, p. 48[120]). Action at the national level is necessary to achieve lasting improvements to land tenure security in forests (Sunderlin et al., 2018[116]). Many countries have taken action to improve national land tenure frameworks, although with various degrees of success (Washim et al., 2014[122]). Brazil is among those countries that have attempted to address the issue of land tenure insecurity with a national policy framework.

Brazil offers the example of a country where synergies between a national policy to increase security of land tenure (*Terra Legal*) and REDD+ programmes being developed in the country (either at project level or at the subnational jurisdictional level) can ease the burden of securing land rights for project proponents. Launched by the federal government in 2009, *Terra Legal* aims at regularising land ownership in the Amazon by granting land titles to around 300,000 smallholders. Compliance with the Brazilian Forest Code is a condition for obtaining land titles within the *Terra Legal* framework (Larson et al., 2013[121]). As of 2018, *Terra Legal* had granted just over 30,000 land titles (GIZ, 2018[123]), but the impact of this programme on deforestation is mixed – with farm size being a significant factor (Lipscomb and Prabakaran, 2020[124]). Some sub-national governments, such as the Government of Acre, have benefitted from federal support within the framework of *Terra Legal* (Duchelle et al., 2014[125]).

In Ghana, rather than through a policy framework, the national government is addressing land tenure insecurity through the use of the Community Resource Management Area (CREMA) mechanism, developed by the Ghanaian government to fight deforestation while tackling issues such as securing land tenure (Soliev et al., 2021[126]). It builds on traditional governance structures and empowers communities within a defined geographic area to manage their territory sustainably while deriving economic and livelihood benefits (Asare, Kyei and Mason, 2013[127]). This approach is now being widely used by REDD+ projects in the country (Soliev et al., 2021[126]). Communities that manage an area targeted by CREMA receive "a certificate of devolution of Authority from the government [that] gives CREMA authority [i.e. the governing body of the area targeted by CREMA] the right to manage the forest resources, including biomass, within the CREMA boundaries", resulting in secure tenure for the community (Asare, Kyei and Mason, 2013, p. 7[127]).

Experience in Indonesia highlights the role that sub-national authorities could play in resolving land tenure issues. A study by Duchelle et al. (2017[108]) that analyses the impact of REDD+ measures on rural

[24] For example, three and 12 sub-national jurisdictions (of 30 examined) had authority over land ownership and logging permits respectively.

households in six REDD+ countries, finds that tenure security had increased over time in Indonesia. The study identifies as a possible contributing factor the fact that "village authorities [were] increasingly playing a strong role in negotiating any conflicting land claims with both internal and external claimants" (Duchelle et al., 2017, p. 6[108]). This ability to negotiate clashing land claims may be due to the proximity of village authorities to the local level where REDD+ projects are implemented. National governments could consider devolving more authority over resolving local land disputes in forests to sub-national levels of governance.

4.3.3. Cross-sectoral policy alignment can make REDD+ implementation more effective

Alignment across policies in different sectors that influence land-use can facilitate REDD+ implementation. Given that governments are faced with multiple and interconnected environmental and economic challenges, aligning policies across different sectors is key to achieving sustainable land use management (OECD, 2020[128]). Although REDD+ programmes are typically developed under the aegis of environment- or forestry-related ministries, it is important to involve a wider number of government agencies "to better inform policy design, enforcement, and the alignment of legislation and programs across the relevant sectors" (EPRI, 2012, p. 4.8[98]). If co-ordination between government agencies is lacking, different sectoral policies risk working towards opposite goals. For example, if policies that aim at reducing deforestation clash with policies that favour economic development based on forest exploitation, deforestation might simply be displaced within the country (i.e. leakage). Cross-sectoral policy alignment (e.g. between incentives for agriculture, and incentives for maintaining forests) can also help mobilise and align capacities across different government agencies to make implementation of REDD+ programmes more effective (UNDP, 2021[102]).

National governments can foster policy alignment by creating entities that bring different government agencies together to discuss matters relating to the implementation of REDD+ in the country. For example, in Mexico, the Inter-ministerial Commission on Climate Change, founded and led by the Ministry of Environment and Natural Resources, created a working group (GT-REDD+, Spanish acronym) to discuss REDD+ development at the national level with the other governmental agencies (Špirić and Ramírez, 2021[129]). For instance, the Ministry of Agriculture and Rural Development (SADER, Spanish acronym) participates in the GT-REDD+.

4.4. Addressing technical issues requires co-ordination between different governance levels

As mandated by the UNFCCC guidance, countries that intend to implement REDD+ activities, have to create a forest reference emission level (FREL) and/or forest reference level, as well as establish a national forest monitoring system (UNFCCC, 2022[130]).[25] FRELs can be determined at different jurisdictional levels, but only the national-level FREL is submitted to the UNFCCC for approval and used as a baseline to receive results-based payments. National forest monitoring systems may result from the integration of sub-national systems depending on national circumstances (UNFCCC, 2022[130]). The data and information provided by these methodological tools must be accurate and suitable for MRV of activities and resulting emissions. Countries are rewarded with results-based finance "on the basis of their success at reducing emissions, measured by national MRV systems against the technically assessed national FREL" (Deschamps Ramírez and Larson, 2017, p. 11[131]).

[25] FRELs are baselines against which the performance of each country in reducing deforestation can be evaluated (UNFCCC, 2022[130]).

National governments could help to co-ordinate the development of FRELs and MRV systems at different levels within the country. In countries where REDD+ activities take place at two or more levels, i.e. project level or sub-national jurisdictional levels or national level, countries have an interest in ensuring that sub-national MRV systems do not clash with national level systems (World Bank, 2021[88]). Moreover, the development of FRELs, as well as the development and use of MRV systems, require technical capacities, resources and monitoring capacities that might not be available to governments at all levels. For example, national governments which might possess remote sensing technologies that are not available to sub-national NPS, could make spatial mapping results available to actors that need them. On the other hand, sub-national NPS might be able to implement better monitoring on the ground due to their proximity to the REDD+ initiatives and could thus complement national efforts. As such, co-ordinating efforts at different levels can help maximise synergies and ensure more efficient implementation of REDD+ within a country.

As the FREL to be submitted to the UNFCCC has to be determined for the entire national jurisdiction, national governments could identify approaches to FREL development that allow for disaggregation at the sub-national level and integrate accurate sub-national level emission data while maintaining consistency between the national and sub-national FRELs. For example, Indonesia's approach to FREL development (called 'national approach with sub-national implementation') envisages the creation of sub-national (i.e. province-level) FRELs and leaves room for input from the sub-national level while ensuring consistency with the national-level FRELs. Indonesia's first national FREL has successfully undergone the technical assessment process by the UNFCCC, meeting all requirements (World Bank, 2021[88]). According to guidance developed by the Indonesian Ministry of Environment and Forestry (MoEF, 2018[132]), sub-national FRELs derive from the national FREL and their aggregation should not exceed the national FREL. Even if for reporting purposes sub-national FRELs derived from national FREL disaggregation should be used "for the sake of consistency", provinces are encouraged to report more accurate deforestation data to the central government (MoEF, 2018, p. 53[132]). The government will use this input to improve the next submission of the national FREL to the UNFCCC.

Mexico's experience with FREL development highlights the need for co-ordination between different governmental levels. Mexico's national REDD+ strategy (approved in 2017) affirms that the country's FREL would be determined in a similar way as Indonesia's FREL[26] (CONAFOR, 2015[133]). The first step would be the establishment of the national FREL, followed by disaggregation into sub-national (i.e. State-level) FRELs. Sub-national FRELs may be improved in line with the guidance provided by each state, and the national FREL can be in turn adjusted through this process, ensuring consistency between the two levels. However, interviews conducted by Deschamps Ramírez and Larson (2017[131]) reveal that sub-national actors involved in the development of State FRELs were unaware of the available methodologies. Interviewees from two States "stressed the need to establish formal agreements between CONAFOR and state governments regarding information sharing and use" (Deschamps Ramírez and Larson, 2017, p. 18[131]).

With respect to MRV systems, national governments can improve data collection by assigning related tasks to national or sub-national entities according to their respective capacities, as done e.g. by the Indonesian government. Under Indonesia's MRV arrangements, national and sub-national institutions share the tasks relating to the monitoring of forest resources according to their respective capacities and resources (MoEF, 2018[132]). A national institution (LAPAN, the National Institute of Aeronautics and Space of Indonesia) provides pre-processed, remote sensing data to the BPKHs (provincial offices of the Directorate General of Forestry Planning and Environmental Arrangement). These sub-national agencies, in turn, perform ground checks to verify the information and collect field data. Based on this, BPKHs create tentative cover land maps of their provinces. Another national agency (IPSDH, the Directorate of Forest

[26] This information is not present in the most updated version of the national REDD+ strategy published in 2017 (CONAFOR, 2017[158]).

Resources Inventory and Monitoring) performs quality control of the tentative maps and creates an integrated land cover map for the whole country.

Indonesia's MRV arrangement indicates that national government agencies are sometimes able to provide NPS with satellite/remote sensing data. This is also the case in Brazil (Aparecido et al., 2021[134]). The data and data models that the Brazilian National Institute for Space Research (INPE,) produces have been used by REDD+ project proponents in the country to set reference emission levels for their project sites (Korhonen-Kurki et al., 2012[87]). Brazilian States such as Acre also use data from the Brazilian Amazon Deforestation Monitoring Project (PRODES) data to create forest reference levels and measure their performance. (Lee et al., 2018[135])

National governments may also provide support to NPS when they lack technical capacities or resources needed to meet requirements for MRV operationalisation. For example, the Mexican federal government provides technical support for MRV operationalisation to Mexican States. Mexico's State-level MRV systems are meant to be consistent with the national MRV system. To keep this consistency, co-ordination between the national and sub-national level is necessary. CONAFOR supports sub-national governments either by providing inputs to the GHG inventories that some states are developing (e.g. Jalisco, Quintana Roo, Yucatan), or by directly providing them with the GHG inventory when needed (Madrid Ramírez, 2020[136]).

4.5. Changing risk/reward profile of low-GHG activities

4.5.1. National governments can ensure benefit-sharing arrangements are put in place

Benefit sharing can be defined as "the reward (monetary or non-monetary) for achieving REDD+ action outcomes" (Guerra and Moutinho, 2020[137]). Davis, Nogueron and Javelle (2012[138]) identify three types of benefits that can be generated from the implementation of a REDD+ initiative: direct cash payments; direct supply of services or goods such as improved infrastructure or land tenure; indirect benefits resulting from REDD+ activities, such as environmental benefits linked to reduced deforestation.

Benefit sharing can be vertical (between stakeholders at the national and at the sub-national level) or horizontal (between and within target communities and other local stakeholders) (Luttrell et al., 2013[139]). Results-based payments for achieving REDD+ emissions reductions are usually made to countries, such as to the Brazilian federal government[27], or to sub-national governments, as is the case of Acre and Mato Grosso[28]. Vertical benefit sharing entails the redistribution of these monetary benefits, received by government authorities, to stakeholders involved in REDD+ implementation at lower levels (including sub-national governments and non-state actors). Horizontal benefit sharing is about how these and other benefits – benefits provided directly by REDD+ activities, such as the distribution of agricultural inputs, or other financial benefits – are redistributed among stakeholders targeted by REDD+ interventions at the local level.

A benefit-sharing mechanism (BSM) for REDD+ can be defined as "the variety of institutional means, governance structures and instruments that distribute finance and other net benefits from REDD+ programmes" (Luttrell, Loft and Kweka, 2012, p. 131[140]). A successful BSM would be effective (in terms of achieving results), efficient (in terms of costs), and fair (in redistributing benefits equitably) (Guerra and

[27] Brazil received results-based payments linked to REDD+ by the Green Climate Fund (GCF) (Sax, 2019[148]).

[28] The two Brazilian States received results-based payments through the REDD+ Early Movers Program (UNDP, 2021[100]).

Moutinho, 2020[137]). However, in practice, there are likely to be trade-offs between these three traits (Pham et al., 2013[141]).

Benefit sharing between different government levels in Brazil follows rules defined by the National Commission for REDD+ (CONAREDD+). While Brazil's national REDD+ strategy does not establish a BSM, the country has set an institutional arrangement whereby States that are interested in implementing REDD+ have to satisfy eligibility criteria established by CONAREDD+ (Bertzky et al., 2021[142]). One of the conditions for sub-national jurisdictions to access results-based REDD+ finance is that they meet a certain performance standard measured against a baseline. CONAREDD+ mandates that 40% of results-based payments received by the country for reducing emissions linked to deforestation should be kept by the central government "due to its efforts in maintaining native forests in protected areas […] and indigenous land" while the remaining 60% is to be shared among the Amazon States (Guerra and Moutinho, 2020, p. 4[137]).

Brazil's approach to benefit sharing distributes benefits not only to actors who reduce carbon emission ('flow'), but also to actors who have played a role in maintaining the forest carbon stock by protecting the forests ('stock'). This approach aims to balance the distribution of incentives between activities focused on protecting forests and activities focused on reducing deforestation (Bertzky et al., 2021[142]). Thanks to this approach, groups such as indigenous peoples, who traditionally protect forests, are able to receive more resources than with benefit-sharing approaches that only reward reduced deforestation. The 60% of results-based payments distributed to the Amazon States by the national government will be shared according to the following criteria: 30% of funding goes to States which maintain native forest (stock), while 30% goes to States that have reduced deforestation (flow) (Guerra and Moutinho, 2020[137]).

Other countries also approach benefit sharing as a way to address equity concerns. For example, Chile intends to allocate equally 50% of REDD+ results-based payments to all regions that participate in the REDD+ implementation effort to cater to the principle of "fairness" (Briceño et al., 2021[143]). As part of this, 20% of the payments will be redistributed based on the individual performance of each region at reducing emissions from deforestation, while a further 10% will be distributed equally to regions that have been affected by catastrophic events in the name of solidarity (Briceño et al., 2021[143]). Nepal's Ministry of Forests and Environment has also embedded social justice considerations into the draft benefit sharing plan of the REDD+ initiative "13 Terai Arc Landscape Districts" (Ministry of Forests and Environment of Nepal, 2020[144]). While the majority (75%) of the monetary benefits derived from REDD+ will be allocated to forest communities and governmental forest agencies conditional on the adoption of sustainable forest management practices, a small proportion (five percent) are earmarked for forest-dependent households who do not belong to the aforementioned groups. The criteria for selecting recipients of this proportion include those living below the poverty line, making it focused on improving the livelihood of poorer households. (Felicani-Robles, Fortuna and Murray, 2021[145]).

National governments can also decide to empower local communities to redistribute benefits autonomously within the community. In Ghana, the CREMA mechanism (see under Addressing land tenure insecurity is key 4.3.2) provides a useful framework to facilitate benefit sharing within the local communities targeted by REDD+ projects. Under CREMA, communities receive non-monetary benefits such as improved land tenure, health programmes and climate-smart agricultural education, as well as monetary benefits directly from the national government (Soliev et al., 2021[126]). The national government receives REDD+ carbon payments and distributes them to communities' trust funds according to their performance in terms of forest conservation. Communities, in turn, "spend the received monetary benefits based on community needs and thereby ensure provision of non-monetary benefits to all participants of CREMA" (Soliev et al., 2021, p. 5[126]). Asare, Kyei and Mason (2013[127]) report that benefit-sharing arrangements are determined internally by CREMA communities and authorities, thus being in line with community values and needs. However, traditional authorities in Ghana, who are the land owners and who allocate lands to community members, have been accused by farmers of preventing benefits from

reaching the poorest members of the community (Bertzky et al., 2021[142]). This highlights the need to monitor the implementation of BSMs of this kind.

4.5.2. Synergies between REDD+ and PES schemes can better achieve REDD+ goals

The use of PES has been an important strategy to achieve REDD+ goals for many years (Börner et al., 2018[90]). PES programmes aimed at avoiding deforestation provide landholders with direct payments that are conditional on the preservation of forest resources or forest conservation practices (Gordillo et al., 2021[146]), thus providing an economic alternative to livelihoods dependent on forest exploitation. Börner et al. (2018, p. 110[90]) report that PES have been "politically feasible, popular among recipients, and can generate meaningful avoided deforestation while supporting household and community livelihoods". PES can accompany command-and-control measures to balance the costs of forest conservation borne by smallholders (Duchelle et al., 2017[108]). Brazil has used a GCF proposal (Sax, 2019[147]) to explicitly link REDD+ finance with PES, by indicating 80% of payments received under the REDD+ programme would be used to fund implementation of a PES programme to preserve native forests in all Brazilian biomes by compensating landholders for environmental services such as monitoring, resource restoration and protection (Ministry of the Environment of Brazil, 2019[148]) (Ministry of the Environment of Brazil, 2020[149]). The use of REDD+ finance to fund PES schemes has also been applied in Cameroon at the project level (CIFOR et al., 2021[150]).

Monitoring and enforcing compliance of landholders to PES contractual obligations is necessary to effectively achieve forest conservation goals (Wunder et al., 2018[151]). To encourage compliance with PES rules, some countries have developed non-compliance provisions such as the suspension or cancellation of payments in Ecuador (FONAFIFO, CONAFOR and Ministry of Environment of Ecuador, 2012[152]) or removal from Mexico's PES programme if there has been deforestation (Cortina and Porras, 2018[153]). Enforcing non-compliance provisions would be important to ensure consistent policy messages. However, an assessment of 70 PES programmes worldwide found that only a quarter of the initiatives had consistently enforced sanctions for non-compliance (Wunder et al., 2018[151]).

5. Conclusions

In order to reach the long-term goals of the Paris Agreement, rapid and sustained decreases in greenhouse gas (GHG) emissions are needed. For this transformation to occur, there needs to be more mitigation action at national, sub-national and project levels by different actors. Non-Party stakeholders (NPS) have a key role to play in this context as their estimated potential for increased mitigation action is significant. Identifying policies, actions and enabling environments that have successfully encouraged mitigation by NPS, can help to replicate such actions in other contexts – while recognising the need to tailor solutions to specific circumstances. It will also be important to identify barriers to these actions – and measures to overcome them – in order to increase the scale, extent, pace and efficiency of NPS mitigation action.

While there is extensive and growing experience with GHG mitigation action by NPS that is documented in the literature, there is less focus on concrete actions that national governments can take to facilitate this NPS action. NPS mitigation experience extends across many countries and sectors, spanning varying types of actions and different types of NPS. Examining these mitigation experiences, and how they have been facilitated (or otherwise) by national-level policies, can shed light on barriers and how they can be overcome. This, in turn, can facilitate increased mitigation action by NPS to support implementation of or enhance national mitigation goals, such as those included in countries' Nationally Determined Contributions (NDCs).

This paper has explored actions that national governments could take to enable, encourage and identify NPS mitigation action in two sub-sectors that have large mitigation potential, and where NPS play a key role in the successful implementation of mitigation activities: renewable electricity (RE) generation in cities, and Reducing Emissions from Deforestation and forest Degradation, REDD+. This paper first identified some barriers to action by NPS in these two sub-sectors. A better understanding of these barriers can help national governments identify promising areas for policy development or review. While recognising that specific policies and measures will need to be tailored to specific country and local contexts, this paper has then highlighted some general actions that national-level governments can take to overcome these barriers.

Table 5.1 lays out several overarching actions that national governments can take to further the uptake of RE in cities, as well as REDD+ activities (in countries where this is applicable). These encompass different areas, including those focusing on general or enabling frameworks, in particular:

- Establishing a clear "direction of travel" at the national level. Such a framework can be prompted by national targets, as well as by an explicit encouragement to sub-national and local governments to establish relevant targets that are – at a minimum – aligned with national ambition. Indeed, some Chinese cities were able to set and achieve RE deployment targets that were more ambitious than those set nationally, in co-ordination with several layers of government.
- Regularly reviewing and potentially revising national policies and institutional arrangements in key areas, to allow for iterative improvements if needed (e.g. following specific comments by NPS stakeholders). While proposed new policies are often open to stakeholder comments before the policy is finalised, inputs are less often requested to assess the effectiveness of policies that have already been implemented. Nevertheless, doing so would enable national governments to identify and then address barriers highlighted by NPS. Reviewing and revising national policies in a

proactive manner may also be considerably less time- and resource-consuming than prompting national policy revision through litigation.

- Centrally publicising relevant information. For example, publicising information about "promising activities" or "good practices" could help increase their dissemination more widely at national level. Publicising information about "good practices" could also help other such activities gain access to international support if it makes information more widely available to possible funders. Providing a platform for sub-national actors to highlight their capacity needs to increase implementation of specific activities could also help to improve access to international sources of finance.

There are also specific actions focusing on institutional, regulatory, technical and financial aspects that national governments can take to further the uptake of RE in cities, and of REDD+ activities. These include:

- Institutional actions such as:
  - Taking steps to ensure that the roles and responsibilities of national governments vs NPS (including regional and local governments) relating to encouraging, enabling, implementing and financing GHG mitigation actions are clear and reinforce each other. For example, in Germany, renewable energy incentive policies are set at national level and sub-national governments can promote RE in cities via e.g. building regulations and land-use planning. Regarding REDD+ activities, national government actions to ensure alignment across policies in different sectors that influence land use (e.g. forestry, agriculture, mining), as well as to ensure that mandates of different ministries are mutually exclusive, are also important.
  - Increasing "vertical" communication between different levels of government and between governments and NPS, as well as increasing "horizontal" (cross-government) collaboration. Such increased collaboration can facilitate input by local governments and other stakeholders with knowledge of the local project context, and is important because sub-national frameworks (e.g. at regional or local level) can vary widely. Communication can be facilitated by mandating a national-level ministry to ensure consistency between national and sub-national actions, and/or by creating multi-stakeholder bodies (as has been done in e.g. Mexico's technical advisory committee for REDD+).
- Regulatory actions, such as:
  - Changes that facilitate the ability for sub-national entities to procure RE electricity, such as from independent power producers (IPPs) and/or to enter into city-wide power purchase agreements (PPAs). For example, the South African electricity regulations were amended to allow procurement from IPPs by municipalities after the city of Cape Town sought this ability. As a result of this regulatory change, other cities in South Africa, such as Ekurhuleni, have also started sourcing some renewable electricity from IPPs. Frameworks to promote the creation of local energy communities have also been used to foster RE development in some cities, i.a., in Portugal.
  - Clarifying and formalising land tenure, as this impacts the ownership of emission reductions resulting from REDD+ activities, and therefore who is incentivised to reduce deforestation. Providing clarity on land tenure is a key enabling action for scaling up REDD+ activities that is in the purview of national governments, yet is still lacking in some REDD+ countries.
  - Ensuring that existing regulations, such as national policies aimed at preserving forests, are systematically enforced, as this can help to reduce deforestation. Potential negative effects on the wellbeing of forest-dependent communities can be mitigated by providing incentives, such as direct payments, to targeted communities.
- Technical actions, such as:
  - Facilitating the collection or access to relevant data at sub-national level, such as local GHG emission levels, drivers of GHG emissions, mitigation potential and costs, or information on

the non-climate benefits of specific project types. Indeed, information on renewable energy potential at city level is rarely available. Increased information availability on potential cost-effective mitigation actions can help increase the uptake of such actions.

- Helping with the data reporting process by providing harmonised formats to collect and report urban RE electricity systems data.

- Actions that increase the financial attractiveness of mitigation options, and/or actions to facilitate NPS access to both national and international financial opportunities. These include:
  - Establishing national-level mechanisms to reduce up-front costs of mitigation actions. For example, high up-front costs can be a key barrier to certain RE projects, as those who implement the project (e.g. households, municipal governments) may have limited access to financial resources. National-level mechanisms, e.g. allowing "net metering", can help increase the economic attractiveness of distributed renewable electricity systems.
  - Establishing financial incentives that make low-GHG activities more economically attractive to pursue. For example, the provision of Payments for Ecosystem Services (PES) can encourage local stakeholders and communities to adopt forest management practices that avoid forest loss.
  - Facilitating benefit-sharing so that the benefits of mitigation actions accrue to actors at different levels – including local stakeholders. Ensuring that REDD+ benefits – which can be monetary or non-monetary – accrue to a variety of stakeholders (including small-holders) can help ensure that the REDD+ activity leads to on-the-ground-results. Indeed, results-based payments for REDD+ received by the Federal government in Brazil are shared between the national and sub-national governments.

Selected successful measures to promote increased levels of RE in cities, or reduced levels of deforestation and forest degradation are included in Table 5.1.

Table 5.1. Selected measures that national governments can adopt to facilitate RE in cities and REDD+

Type of measure	Renewable energy in cities	Reducing deforestation and forest degradation
Enabling measure	Allow for electricity procurement and net metering from independent power producers	Enhance or clarify land tenure security to support successful REDD+ activities
	Establish a one stop shop that brings together a variety of actors (national and municipal governments, private companies etc) relating to renewable energy financing opportunities	Facilitate co-ordination and alignment of REDD+ processes at different levels of governance
	Collate and facilitate access to city-level data on RE mitigation potentials and costs	Facilitate access to disaggregated data from satellite monitoring by sub-national actors
Incentives	Introduce feed-in tariffs	Provide performance-based payments for forest protection
	Establish targeted subsidies, tax incentives, innovative finance mechanisms	Adopt and implement a benefit-sharing mechanism
	Establish public-private partnerships and power purchase agreements to leverage funds from external partners	
Disincentives	-	Impose penalties for non-compliance with forest protection regulations
Other	Supporting development of local-level electricity storage solutions for RE Facilitating access to international sources of finance by cities Ensuring information on tax exemptions for RE equipment is widely available to support application	Facilitate transfer of knowledge and information between key actors Official endorsement of specific sub-national activities to help increase interest in such activities

Source: Authors

To conclude, while a national policy framework is a crucial enabler for mitigation action, so is NPS action on the ground that is informed by context-specific realities. National governments have several options to support further GHG mitigation actions from NPS, and to enhance the interaction between national policies and NPS policies and actions. These options include overarching actions such as developing as holistic as possible an understanding (both supply and demand side) of emission reduction potentials, as well as of where NPS, in particular sub-national governments, can provide insights on barriers and solutions to speeding up the achievement of national climate goals. Other actions could be targeted at the regulatory and institutional framework in specific sectors, e.g. by ensuring that this framework incentivises mitigation policies and actions by NPS. National governments could also address other implementation barriers, for example by providing targeted incentives or disincentives for NPS actions. An important, common element for the success of these actions is co-ordination between national governments and NPS. This requires identification of where each actor, including NPS, can play their role most efficiently, and ensuring responsibilities are clearly defined. A good flow of information and data between national governments and NPS is also an important element for the success of NPS action, and – as illustrated in this paper - can be facilitated by specific national government actions. Finally, regular reviews of national policies in key areas could enable national governments to iterate as needed to reduce or remove barriers to further NPS mitigation action.

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