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An integrated approach to the Paris climate Agreement: The role of regions and cities

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An Integrated Approach to the Paris Climate Agreement: The Role of Regions and Cities

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Following the historic 2015 Paris Agreement aiming to limit global temperature rise to well below 2°C above pre-industrial levels by 2100, 165 Intended Nationally Determined Contributions, representing 192 countries, have been submitted. Nationally Determined Contributions (NDCs) detail each Party's efforts to reduce domestic greenhouse gas (GHG) emissions and adapt to the impacts of climate change. This paper, recognising the role of cities and regions in implementing the Paris Agreement, highlights the need for an integrated approach in implementing NDCs and long-term low GHG emission development strategies (LT-LEDS) and attempts to present key policy options for such an approach. First, the paper identifies the national and subnational co-ordination mechanisms in current NDCs, LT-LEDS and other subnational climate strategies and argues that the current processes of developing and implementing NDCs and LT-LEDS provide a unique opportunity for national governments to integrate innovative subnational climate action. The paper then assesses the potential for co-ordination of national, regional and local climate mitigation investment through the lens of the *OECD Recommendation on Effective Public Investment Across Levels of Government* adopted in 2014.

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Keywords: Climate change, Paris Agreement, Nationally Determined Contributions (NDCs), long-term low greenhouse gas emission development strategies (LT-LEDS), public investment, cities, mitigation, infrastructure

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1 Introduction

Addressing climate change is a global challenge with local impacts, requiring immediate and transformative action. Preliminary data from the World Meteorological Organisation indicates that atmospheric carbon dioxide (CO_2) concentrations may exceed 410 parts per million by the end of 2019 (WMO, 2019), which is unprecedented over the last three million years (WMO et al., 2019). Total greenhouse gas (GHG) emissions attained a record 55.3 gigatonnes of carbon dioxide equivalent ($GtCO_2e$) in 2018 and have risen at a rate of 1.5% per year over the last decade (UNEP, 2019).[1] In the energy sector, global energy-related CO_2 emissions grew by 1.7% in 2018, reaching a historic level of 33.1 Gt: by 2040, projections based on currently implemented policies indicate a global increase to 42.5 Gt (IEA, 2018). Moreover, by the end of 2017, approximately 2 200 (± 320) of anthropogenic $GtCO_2$ were already emitted – leaving only an estimated 580 $GtCO_2$ required for a 50% chance of limiting the global temperature rise to 1.5°C by 2100 – meaning that global warming is likely to reach 1.5°C between 2030 and 2052 at current rates (IPCC, 2018).

The risks associated with a 2°C warmer world include species extinction, global and regional food insecurity, consequential constraints on human and economic activities and limited potential for adaptation (IPCC, 2018; IPCC, 2014), such as in certain low-lying Pacific nation-states where migration may be the only solution (Smith & McNamara, 2015). To lessen these risks and retain a 50% chance of limiting the global temperature increase to 1.5°C, mitigation efforts would need to secure carbon neutrality, net-zero GHG emissions, in about 30 years (IPCC, 2018). The longer ambitious climate action is delayed, the greater the damage to the economy and to society (OECD, 2017a; OECD, 2019a).

Meanwhile, the direct impacts of climate change can already be felt: glaciers have shrunk, ice on rivers and lakes is breaking up earlier, heat waves are longer and more intense, plant and animal ranges have shifted and sea-level rise is accelerating (WMO et al., 2019; IPBES, 2019; IPCC, 2014). Recent modelling projections for a high-end sea-level rise scenario (1.3 metres) indicate that coastal flooding may incur annual damage costs up to USD 50 trillion – nearly 4% of global GDP – by the end of the century without adequate adaptation measures (OECD, 2019b). Globally the number of weather-related loss events, including floods and droughts, have increased significantly, from 222 in 1980 to 683 in 2017 (Munich RE, 2018). These disasters have generated growing economic, social and environmental costs to urban areas, as urbanisation and industrialisation advance.

The adoption of the Paris Agreement (the Agreement) in 2015 has generated strong momentum for all actors to commit to climate action as a collective task to achieve global commitments (Box 1). In parallel, the 2030 Agenda on Sustainable Development includes a dedicated goal on climate that seeks to "take urgent action to combat climate change and its impacts" (SDG #13). This goal, together with other climate-

[1] Carbon dioxide equivalent (CO_2e) emission is defined by the IPCC as: "The amount of carbon dioxide (CO_2) emission that would cause the same integrated radiative forcing or temperature change, over a given time horizon, as an emitted amount of a GHG or a mixture of GHGs. There are a number of ways to compute such equivalent emissions and choose appropriate time horizons. Most typically, the CO_2-equivalent emission is obtained by multiplying the emission of a GHG by its global warming potential for a 100-year time horizon" (IPCC, 2019).

related SDGs,[2] foresees efforts to reduce GHG emission emissions as well as to strengthen the resilience and the adaptive capacity of places to climate-related hazards and natural disasters.

The Agreement establishes commitments by all Parties to prepare a Nationally Determined Contribution (NDC) and to pursue domestic measures to achieve them. To date, 165 Parties – representing 192 countries – have communicated their Intended Nationally Determined Contributions and respective GHG emission targets, representing a first step to cement the commitment of national governments and to frame actions within and across countries.[3] The Agreement also requests all Parties to strive to formulate and communicate long-term low GHG emission development strategies (LT-LEDS), thirteen of which have already communicated their LT-LEDS (UNFCCC, 2019). LT-LEDS represent a crucial opportunity for countries to develop a long-term vision capable of capturing the economy-wide transformations needed to achieve the goals of the Paris Agreement (Rocha & Falduto, 2019). The long-term perspective adopted by LT-LEDS is also important to inform and generate momentum for the shorter-term climate action of the NDCs (Rocha & Falduto, 2019). Guided by their Nationally Determined Contributions (NDCs) and LT-LEDS, most countries are currently in the process of reviewing their existing climate policy frameworks and developing the implementation strategies.

While the development of NDCs is a good start, the currently submitted NDCs in aggregate are reported to be insufficient to limit the global temperature increase to 1.5°C, even if they are supplemented with very challenging increases in the scale and ambition of mitigation after 2030 (IPCC, 2018). More ambitious actions, especially an effective, co-ordinated “whole-of-government” and “whole-of-society” approach, are required to deliver the Paris Agreement.

This paper recognises the pivotal role of cities and regions in achieving a country’s NDCs and LT-LEDS and sets out three questions:

- How are national, regional and local governments currently co-ordinating among themselves to achieve the national climate pledges set in their respective NDCs and LT-LEDS?
- How can the effectiveness of such co-ordination mechanisms be assessed and enhanced?
- What are key issues to make the co-ordination mechanisms more effective and to accelerate an integrated approach in implementing the Paris Agreement?

To answer these questions, the following section reviews literature on the role of subnational governments in climate-related policies and identifies the opportunities and challenges for an integrated approach among different levels of government in implementing the Paris Agreement. Section 3 then analyses the co-ordination mechanisms in the current NDCs, LT-LEDS and subnational climate plans of three countries and a subnational government (state), arguing that the process of developing and implementing NDCs and LT-LEDS provides a unique opportunity for better co-ordination and alignment across levels of government. Considering the involvement of significant public investment in the implementation of NDCs, Section 4 introduces the *OECD Principles on Effective Public Investment Across Levels of Government* (adopted in

[2] Other climate-related SDGs include: SDG #6 (Clean Water and Sanitation), SDG #7 (Affordable and Clean Energy), SDG #11 (Sustainable and Resilient Cities), SDG #12 (Responsible Consumption and Production), SDG #14 (Life below Water), and SDG #15 (Life on Land).

[3] As a methodological note concerning Intended Nationally Determined Contributions (INDCs) and NDCs: Parties to the United Framework Convention on Climate Change (UNFCCC) were invited to communicate their INDCs in advance of the 21st Conference of the Parties (COP21). An INDC can only officially become considered a NDC after a Party has ratified the Paris Agreement. Hence, when the EU – a party to the UNFCCC – ratified the Paris Agreement on 5 October 2016, its INDC officially became a NDC. Practically speaking, the total number of INDCs can be considered to amount to 165 rather than 192 *per se*, since the EU submitted its NDC on behalf of all of its 28 Member States.

March 2014) and applies them to climate change mitigation investment as a framework to assess the effectiveness of co-ordination mechanisms. Several examples from OECD countries are provided to document a diversity of situations against the OECD Principles in terms of investment needs for climate policies, but also in terms of institutional organisation (federal vs. unitary). The paper concludes with a section presenting potential ways forward in terms of future areas of research. Overall, the paper argues for an integrated approach in delivering the Paris Agreement.

The main methodology relied on desk research reviewing national and subnational climate plans and strategies obtained through government websites, and relevant research papers and articles from research institutions.

Box 1. The Paris Agreement

The Paris Agreement (the Agreement) was adopted on 12 December 2015 at the 21st Conference of the Parties (COP21) of the United Nations Framework Convention on Climate Change (UNFCCC). The Agreement aims to strengthen the global response to climate change over the course of the 21st century by:

- i) "holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change"; ii) "increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production"; and iii) "making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development" (Article 1, UNFCCC, 2015).

The Agreement's other key aspects include:

- *Long-term temperature goal (Art. 2)* – The Agreement reaffirms the goal of limiting global temperature increase to well below 2°C while pursuing efforts to limit the increase to 1.5 °C.
- *Non-regression (Art. 3)* – The Agreement stipulates that Parties' efforts may only progress in the future while recognizing that developing country Parties may require corresponding support for effective implementation.
- *Mitigation (Art. 4)* – The Agreement stipulates that all Parties prepare, communicate and maintain successive Nationally Determined Contributions (NDCs) and pursue domestic measures to achieve them.
- *Enhanced carbon sinks (Art. 5)* – The Agreement calls for action to conserve and enhance GHG sinks and reservoirs such as forests.
- *Voluntary cooperation/Market- and non-market-based approaches (Art. 6)* – The Agreement recognizes the possibility of voluntary co-operation among Parties to allow for higher ambition and sets out principles for any co-operation that involves internationally transferred mitigation outcomes.
- *Adaptation (Art. 7)* – The Agreement establishes a global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change.
- *Loss and damage (Art. 8)* – The Agreement enhances the Warsaw International Mechanism on Loss and Damage in order to develop approaches to help vulnerable countries cope with the

adverse effects of climate change, including extreme weather events and slow-onset events such as sea-level rise.

- *Finance, technology and capacity building support (Art. 9, 10 and 11)* – The Agreement reaffirms the obligations of developed country Parties to support the efforts of developing country Parties to build clean, climate-resilient futures, while for the first time encouraging voluntary contributions by other Parties.
- *Education and public engagement (Art. 12)* – The Agreement recognises the importance of climate change education, training, public awareness, public participation and public access to information, by stipulating that Parties co-operate and enhance such measures.
- *Transparency (Art. 13)* – The Agreement relies on a robust transparency and accounting system to provide clarity on action and support by Parties.
- *Global Stocktake (Art. 14)* – The Agreement establishes a "global stocktake." to take place in 2023 and every 5 years thereafter in order to assess collective progress toward meeting the purpose of the Agreement in a comprehensive and facilitative manner.
- *Implementation and compliance (Art. 15)* – The Agreement establishes an expert committee to facilitate implementation of, and promote compliance with, the Agreement's provisions, with flexibility for Parties' respective national capabilities and circumstances.
- *Note: Articles 16-29 detail administrative management of the Agreement.*

Source: UNFCCC (2015), *The Paris Agreement*, United Nations Framework Convention on Climate Change (UNFCCC), 21st Conference of the Parties, https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

2 Opportunities and challenges for an integrated approach to climate policies

Cities and regions have a unique capacity to address climate change compared with national governments. While it is widely argued that cities are both part of the problem and part of the solution to addressing climate change (OECD, 2010; OECD/Bloomberg, 2014), it is not necessarily clearly understood how cities and regions can work together with national governments in achieving nationally determined climate targets. This section thus reviews and articulates how climate policies at the local and regional levels can contribute to advancing national-level climate targets, and identifies the opportunities and challenges for an integrated approach among local, regional and national governments to implement the Paris Agreement. While the following sections mainly focus on subnational climate action on mitigation, this section discusses both mitigation and adaptation, in order to demonstrate the capacity of cities and regions in a wider context.

Relevance: the leading role of subnational governments in climate action

Cities are attracting increasingly larger proportions of the global population, wealth and productivity. More than half of the world's population (54.5% in 2016) lives in cities, and the number is projected to reach 70% – 6.7 billion people – by 2050 (UN, 2018). Cities generate more than 80% of global GDP (CUT, 2019; Dobbs et al., 2011) and the largest metropolitan areas are often as economically powerful as major countries: Tokyo's economic output is comparable to that of Korea, the world's 15th largest economy; New York's is comparable to Canada's; Los Angeles's to Australia's; and London's to that of the Netherlands (Florida, 2018; OECD, 2019c).

In regards to addressing climate change, cities account for disproportionate percentages of global GHG emissions and primary energy use, while they are also vulnerable to climate change impacts:

- Cities contribute over 70% of energy-related CO_2 emissions and account for around two-thirds of global energy demand. If current trends continue, global urban primary energy use would grow by about 70% and global urban CO_2 emissions by about 50% between 2013 and 2050 (IEA, 2016).
- Lifestyles of urban dwellers including how they move around, how they use energy at home, and how buildings are heated influence the amount of GHG emissions. It has been widely documented that CO_2 emissions from transport tend to be higher in low density urban areas without effective public transport network (OECD, 2010; C40, 2011). For instance, North American countries with high personal vehicle use produce 50% more CO_2 emissions than European countries (Kamal-

Chaoui and Robert, 2009). In terms of the generation of GHG emissions, it is not only the amount of energy consumed, but also the source of energy that matters.

- Much of the world's urban population lives in low-lying coastal areas, which are especially at risk of a changing climate. Average global flood losses could increase to USD 52 billion by 2050 in 136 of the world's largest coastal cities, even in the absence of climate change (OECD/Bloomberg, 2014). In Europe, 70% of the largest cities have areas that are less than 10 metres above sea level (Kamal-Chaoui and Robert, 2009). Port cities in developing and developed countries are at risk for coastal flooding.
- Local urban heat island can increase local temperatures, alter small-scale processes (e.g. land-sea breeze effect) and modify meteorology (IPCC, 2014). These effects, coupled with extreme storm and heat impacts, can damage physical and social infrastructure, which is the basis of productivity and competitiveness. The increased temperatures in urban areas due to heat island effects may increase energy demand for space cooling, further driving up energy demand during higher peak loads (IEA, 2016).
- Recent work has concluded that poor, elderly and economically vulnerable populations are likely to be hit hardest by climate change impacts. Low-income populations often concentrated in inner-city areas are more vulnerable as they lack resources to quickly and effectively respond in a timely manner. Climate change thus risks further entrenching structural inequalities in cities (OECD, 2018a).

Cities are also an essential part of the solution to addressing climate change and its impacts. Urban policies have a critical role to play in both adaptation and mitigation climate action by strategically improving urban form, lifestyles, mobility and energy sources that influence GHG emissions:

- Cities and regions implement most climate policies and are well positioned to experiment and pilot climate actions within their geographical areas. It is estimated that 50% to 80% of adaptation and mitigation actions already are or will be implemented at the subnational level (Regions4SD, 2016), implying that the majority of climate action of a country cannot be carried out without subnational governments.
- GHG emissions in cities can be brought close to net-zero using proven technologies and practices, as underscored in CUT (2019), which identifies numerous technically feasible low-carbon measures capable of reducing emissions from key urban sectors by almost 90% by 2050: 58% of which stems from the buildings sector, 21% from transport, 16% from materials efficiency and 5% from waste. While the investments to reduce such urban emissions are estimated at US$1.83 trillion per year (about 2% of global GDP), they are also estimated to generate annual savings worth US$2.80 trillion in 2030 and US$6.98 trillion in 2050 (CUT, 2019).
- Urban authorities have some level of policy authority over various sectors, such as housing, land-use zoning, transport, natural resources management, buildings, and waste and water services. Climate action at the subnational level can be driven through local regulations, urban services, programme administration, city purchasing and property management, and convening of local stakeholders.
- Long-term strategic planning at the local level can better consider policy complementarities in different sectors. For example, land-use zoning policies that encourage higher densities can lead to reduce trip distances and frequency in the transport sector. Natural resource policies to increase vegetation and green space can reduce the impacts of heat extremes and flooding. Such local efforts can be complemented with tailored building standards and energy retrofit projects, such as Berlin's retrofitting of government-owned buildings and Toronto's large-scale tower renewal programme targeting concrete frame apartment towers built between 1945 and 1985 (OECD,

2013). Urban regeneration projects can take into account climate objectives as is the case of the eco-quartier projects in France.

- Urban climate action and investment in low-carbon, climate-resilient urban infrastructure can provide additional co-benefits such as avoided health costs, cost savings and increased efficiency, energy security and infrastructure improvements, and improved quality of urban life (IPCC, 2014). Green urban investment, for instance in public transport and green innovation clusters, can also contribute to increasing economic growth potential in multiple ways including job creation, attracting firms and workers, innovation and entrepreneurship and increasing the value of urban land (OECD, 2013). In particular low-carbon innovation has a strong potential for economy-wide co-benefits, including through technologies for renewable energy, energy storage, smart grids, heating and cooling in buildings as well as for laboratory-grown meat and permeable pavement and road materials, for instance (OECD/World Bank/UNEP, 2019).

Public authorities can invest the income earned through carbon-pricing instruments or energy savings from green buildings in sustainable, low-carbon initiatives that benefit low-income populations. For example, regressive impacts from transport taxes can be reduced, as has been done in London, where revenues from congestion charges are invested in efforts to extend and improve public transport access and services (Box 2) (OECD, 2019c). Other effective green fiscal instruments, based on context-appropriate tariffs and taxes designed in a non-regressive manner, include water and waste pricing mechanisms (e.g. abstraction charges, waste incineration taxes), which enable local governments to boost and diversify their own-source revenue (OECD, 2017b; OECD, 2016; OECD, 2015b).

In fact, cities have made their own climate commitments and implemented various types of mitigation and adaptation policies since as early as the 1990s.[4] Cities' actions encompass a wide range of mitigation and adaptation measures, from installing solar panels, conducting building renovations and implementing congestion charges to maintaining and expanding green spaces, constructing porous infrastructure and reclaiming waste water. Cities and regions are taking bold climate action and setting original GHG emissions reduction targets, many of which are more ambitious than those of their national governments (Table 1, Table 2, Box 2): for instance, several cities have announced a carbon neutrality target extending beyond the ambition of their respective national government – e.g. Copenhagen (2025 city target), Helsinki (2035), Stockholm (2040), Sydney (2050) – demonstrating the strong leadership role adopted by local governments. In the United States, an analysis of city climate action in 2015 found that 52 of the 132 cities that reported their climate commitments to public platforms had reduction targets that were equal to, or more ambitious than, those of the national government (ICLEI USA, 2017).

Table 1. GHG emissions targets of selected cities and of their respective countries

City (Country)	City Target	Country Target
Berlin (Germany)	60% reduction in GHG emissions by 2030, 85% by 2050, both relative to 1990 baseline	Minimum 55% reduction in GHG emissions by 2030, 80-95% by 2050,both relative to 1990 baseline
Copenhagen (Denmark)	Carbon neutrality by 2025	Minimum 40% reduction in GHG emissions by 2030, relative to 1990 baseline (EU target)
Helsinki (Finland)	Carbon neutrality by 2035	Minimum 80% reduction in GHG emissions by 2050, relative to 1990

[4] The first subnational climate policy found its roots in Toronto, Ontario in 1990, when the state government adopted a GHG emissions reduction plan.

Jakarta (Indonesia)	30% reduction in GHG emissions by 2030, relative to business-as-usual projection for 2030	Unconditional target: 29% reduction in GHG emissions by 2030, relative to business-as-usual projection Conditional target: up to 38% reduction in GHG emissions by 2030, relative to business-as-usual projection (conditional on international support)
London (United Kingdom)	Carbon neutrality by 2050	Carbon neutrality by 2050
Madrid (Spain)	35% reduction in CO_2 emission by 2020, relative to 2005 baseline	Minimum 40% reduction in GHG emissions by 2030, relative to 1990 baseline (EU target); Spain has proposed legislation for carbon neutrality by 2050
Paris (France)	30% reduction in GHG emissions by 2020, 50% by 2030, 75% by 2050, all relative to 2004 baseline	Minimum 40% reduction in GHG emissions by 2030, relative to 1990 baseline (EU target); carbon neutrality by 2050
Rio de Janeiro (Brazil)	20% reduction in GHG emissions by 2020, relative to 2005 baseline	37% reduction in GHG emissions by 2025, relative to 2005 baseline
Santiago (Chile)	30% reduction in GHG emissions by 2030, relative to business-as-usual projection	Unconditional target: by 2030, 30% below 2007 GHG intensity of GDP Conditional target: by 2030, 35-45% below 2007 GHG intensity of GDP (conditional upon international financial support)
Stockholm (Sweden)	Carbon neutrality by 2040	Minimum 40% reduction in GHG emissions by 2030, relative to 1990 baseline (EU target); carbon neutrality by 2050
Sydney (Australia)	Carbon neutrality by 2050	26 to 28% reduction in GHG emissions by 2030, relative to 2005 baseline
Tokyo (Japan)	30% reduction in GHG emissions by 2030, relative to 2000 baseline	26% reduction in GHG emissions by 2030, relative to 2013 baseline
Vancouver (Canada)	50% reduction in GHG emissions by 2030, 80% by 2050, both relative to 2007 baseline	30% reduction in GHG emissions by 2030, relative to 2005 baseline

Note: Carbon neutrality signifies net-zero GHG emissions.
Source: Author elaboration based on the carbon*n* Climate Registry (2019) as well as publicly available urban- and national-level GHG emission reduction plans.

Several regions have also declared ambitious targets to achieve carbon neutrality. Jämtland (Sweden) and Helsinki-Uusimaa (Finland) set targets as early as 2030 and 2035, respectively, while Catalonia (Spain), the Australian Capital Territory and Queensland (Australia) have established a 2050 target for carbon neutrality (Table 2). The latter three were recently joined in their 2050 target by five other regions and states – the state of California, the state of Hawaii and the state of New York (United States), South Australia and Victoria (Australia) – that have signed up to the "Climate Ambition Alliance", a new initiative announced at the UN Climate Action Summit 2019 that brings together countries, businesses, investors, cities and regions aiming to achieve carbon neutrality by 2050 (NAZCA, 2019; IISD, 2019). Moreover, 112 state and regions, representing over 800 million people and up to 23% of the global economy, have joined the Under2Coalition and signed a memorandum of understanding that establishes a commitment for a GHG emissions reduction of 80-95% below 1990 levels by 2050 (Under2Coalition, 2019).

Table 2. GHG emissions targets of selected regions/states and of their respective countries

Region/State (Country)	Region/State Target	Country Target
British Columbia (Canada)	80% reduction in GHG emissions by 2050, relative to 2007 baseline	30% reduction in GHG emissions by 2030, relative to 2005 baseline
Catalonia (Spain)	Carbon neutrality by 2050	Minimum 40% reduction in GHG emissions by 2030, relative to 1990 baseline (EU target); Spain has proposed legislation for carbon neutrality by 2050 (not implemented as of 30 September, 2019)

Helsinki-Uusimaa (Finland)	Carbon neutrality by 2035	Minimum 80% reduction in GHG emissions by 2050, relative to 1990
Jalisco (Mexico)	50% reduction in GHG emissions by 2050, relative to 2010 baseline	Unconditional target: 25% reduction in GHG emissions and black carbon emissions by 2030, relative to business-as-usual projection Conditional target: 40% reduction in GHG emissions and black carbon emissions by 2030, relative to business-as-usual projection
Jämtland (Sweden)	Carbon neutrality by 2030	Minimum 40% reduction in GHG emissions by 2030, relative to 1990 baseline (EU target); carbon neutrality by 2050
Thuringia (Germany)	95% reduction in GHG emissions by 2050, relative to 1990 baseline	Minimum 55% reduction in GHG emissions by 2030, 80-95% by 2050, both relative to 1990 baseline
Queensland (Australia)	Carbon neutrality by 2050	26-28% reduction in GHG emissions by 2030, relative to 2005

Note: Carbon neutrality signifies net-zero GHG emissions.
Source: Author elaboration based on CDP (2019a) and Under2Coalition (2019) as well as publicly available regional-/state- and national-level GHG emissions reduction plans.

Several studies have attempted to quantify the mitigation potential of subnational and non-state initiatives (Blok et al., 2012; UNEP, 2015, Yale/NCI/PBL, 2018; GCOM, 2018; C40/NCI, 2017; C40, 2017). An analysis of the GHG emission targets of approximately 6 000 subnational governments and 2 000 companies – located in Brazil, China, the EU, India, Indonesia, Japan, Mexico, Russia, South Africa and the US – suggests that in 2030 they could contribute to an additional emission reduction of 1.5 to 2.2 $GtCO_2e$ per year beyond the reduction expected from current national government policies (Yale/NCI/PBL, 2018).[5] Studies have also attempted to quantify the mitigation potential of international initiatives – such as C40 Cities Climate Leadership Group, the Global Covenant of Mayors, Local Governments for Sustainability (ICLEI) – in comparison to NDCs (Graichen et al., 2017), as well as gauge the feasibility of linking heterogeneous climate policies between scales of government (Mehling et al., 2017). Publicly accessible subnational climate data platforms such as the carbon*n* Climate Registry (2019) and CDP's Open Data Platform (CDP, 2019b) have become increasingly common, facilitating analysis and comparability of updated climate data and policies (Pauw et al., 2018).

[5] The GHG emissions reduction potential of the 6 000 selected subnational governments was not assessed independently, but instead was considered alongside that of the 2 000 selected companies. The overall GHG emissions reduction estimate accounts for overlaps between these actors' commitments and supposes that they are fully implemented and do not change the pace of action elsewhere (Yale/NCI/PBL, 2018).

Box 2. Innovative policy approaches to climate action in cities

Cities are pioneering innovative policy approaches to climate action which could be scaled up. A selection of illustrative examples is provided below:

- In 2003, London (United Kingdom) introduced a congestion charge that levies a fee on most motor vehicles in the city centre in order to reduce the flow of traffic and improve air quality. In 2019, the ambition of the congestion charge was bolstered with stricter emissions standards, and operates every hour and day of the year. Within the first year, the charge led to a 30% reduction in traffic congestion, and to date, has generated £2 billion in revenue since 2003, which has all been reinvested in the city's transport infrastructure (C40, 2019).
- Yokohama (Japan) piloted the Yokohama Smart City Project to mitigate climate change through improvements in energy efficiency and energy management. The city introduced a community energy management system which linked individual emergency management systems (e.g. commercial and residential buildings and factories) to stationary energy storage. Specific achievements of the programme included the installation of emergency management systems in 4 200 homes, the introduction of 2 300 electric vehicles and of 37 megawatts of photovoltaic generation, and the reduction of 39 000 tonnes of CO_2 emissions (IEA, 2016).
- Hedensted (Denmark) used to cool its computer servers using regular ventilation, but has moved to a new solution using a technology that re-uses the heat generated by the servers. Performance-based procurement made it possible for the market to find an innovative solution to save money and reduce CO_2 emissions and resource consumption. Overall, the municipality saves approximately 10 000 litres of oil a year which corresponds to an annual saving of 28 tonnes of CO_2 (OECD, 2015).

Source: C40 (2019); IEA (2016); OECD (2015).

Urgency: opportunities and challenges for an integrated approach

While cities have the aforementioned ability to address the challenges related to climate change, they cannot realise their full potential without effective co-ordination with regional and national governments. The Coalition for Urban Transitions' recent flagship report, *Climate Emergency, Urban Opportunity* (2019), stressed national governments' key roles in securing economic prosperity and lessening the impacts of climate change by transforming their cities. National governments have a key role in funding sustainable urban infrastructure, in leveraging their essential role in shaping global agendas, in supporting city- and community-led climate initiatives, and in aligning national and local policies through cross-cutting frameworks such as national urban policies and NDCs (CUT, 2019).

It is estimated that local governments have direct power over less than a third of GHG emissions reduction potential in their cities, with over two-thirds depending on either national and state governments or co-ordination across levels of government (CUT, 2019). Cities also have far less power in important domains such as energy supply and internet connectivity technology compared to areas such as water, buildings, waste and transport (C40/Arup, 2016). A lack of power in the latter policy areas may hinder certain mitigation measures sought by local governments.

It is also observed that national and subnational governments have set up different policy targets, which may sometimes be confusing, if not conflicting with each other. For instance, the GHG reduction target in Santiago (Chile) is based on an absolute GHG reduction against the business as usual scenario, whereas the national-level target is based on GHG intensity of GDP (Table 1). Moreover, in some cases, GHG emissions and energy consumption reported by national and subnational governments cannot be compared, since each level of government uses different methodologies to calculate GHG emissions and energy consumption.

Vertical co-ordination challenges are commonly observed in sectoral policies as well. Regarding energy supply, for example, local governments' energy mix or emission reduction targets may be constrained by their limited authority over legal instruments to implement such targets. For example, the Tokyo Metropolitan Government has set a target of increasing the share of renewable energy in the electricity consumption of the Tokyo area to 20% from 6% in 2012, by promoting solar PV and biomass generation within Tokyo and investing in renewable energy funds outside Tokyo (Tokyo Metropolitan Government, 2014). However, national laws do not give authority to subnational governments to oblige retail electricity operators to supply certain amounts of renewable energy in their jurisdictions, which makes it uncertain to meet the target. The absence of co-ordination between levels of government may lead to policy design that fails to allow subnational governments to realise their full mitigation potential (OECD, 2015a).

Climate finance and investment in terms of both providing and receiving finance, is another area that requires more co-ordinated actions across levels of government. There is a clear case for documenting the range of financial instruments (e.g. green bonds, land value capture, transfers, congestion charging) that cities and regions can use to accelerate more ambitious climate actions and transition to a low carbon economy. However, cities and regions can face limited access to financial markets and mechanisms and international climate finance to fund low-carbon development, due to the country's framework conditions. For example, cities generally have lower credit ratings than their respective national governments, especially in developing countries. Only 4% of the 500 largest cities in developing countries are considered creditworthy in international financial markets and only 20% in local markets (World Bank, 2013, quoted in OECD/Bloomberg, 2014). There are also sovereign limits on how much or if a city can borrow from the private sector (OECD/IEA/NEA/ITF, 2015; OECD, 2014; Merk et al., 2012).

These are just a few examples of a "misalignment" between national and subnational governments. Countries and regions should be able to help cities cultivate their full potential in various policy areas by playing complementary roles and co-ordinating with cities. National governments can provide a legal framework, set incentives and co-ordination mechanisms, allocate funding and scale up innovative subnational climate action; regions can facilitate vertical co-ordination between the national and local level, as well as horizontal co-operation across local authorities within their territories, through measures such as metropolitan-regional climate action plans or policies to promote urban-rural linkages for climate change. (OECD, 2019c; OECD, n.d.). An important ensuing policy question concerns how national, regional and local governments can effectively co-ordinate to achieve national climate pledges.

In order to better understand the status quo of the current co-ordination mechanisms between levels of government and provide insight into how national governments can design effective co-ordination mechanisms with cities and regions in climate policies, the next sections focuses on two key areas: 1) co-ordination frameworks in NDCs, LT-LEDS and subnational climate plans; and 2) multi-level coordination in climate mitigation investment.

3 Assessing NDCs, LT-LEDS and subnational climate plans

In recent years, numerous studies have underscored the extent to which multi-level governance frameworks can scale up climate action. In particular, urban climate governance has been studied in-depth for many years by international organisations such as the OECD and UN-Habitat (OECD, 2010; UN-Habitat, 2011), as well as by academics, who have, for instance, assessed the extent to which the inclusion of non-state and subnational actors in urban climate governance advances other social agendas and sets a leadership role for cities (Bulkeley & Castán Broto, 2013; Broekhoff et al., 2015; Chan et al. 2018). These studies provide a strong rationale for multi-level co-ordination in the context of implementing the Paris Agreement.

The extent to which Nationally Determined Contributions (NDCs) adopt an integrated approach has also been increasingly scrutinised in recent literature. A preliminary review conducted by UN-Habitat classified NDCs according to level of attention granted to urban content, finding that two-thirds (113) of 164 NDCs mentioned urban key words in the context of national priorities and ambitions for reducing GHG emissions. Of these 113 NDCs, 26 included “strong” urban content and 87 included “moderate” urban content (UN-Habitat, 2017). Focusing on a similar theme, Hsu et al. (2019b) recently found that neither subnational governments nor non-state actors are detailed in the NDCs of 45 countries (including the EU-28 for which there is only one NDC): furthermore, eighty percent of the countries failing to address subnational governments or non-state actors in their NDCs are developed countries.

These NDC studies provide innovative assessments of the inclusion of subnational climate action in NDCs, but in-depth analysis of the co-ordination mechanisms between levels of government and discussion of effective policy options are lacking in the academic literature. Indeed, these studies performed wide-ranging textual analysis (e.g. language/keyword assessments) across NDCs but did not delve into comprehensive assessment of multi-level governance arrangements and co-ordination mechanisms. Moreover, there is also a need to broaden the scope of analysis beyond NDCs alone in order to consider other national and subnational climate plans.

Hence, this section builds on the present body of research in order to assess co-ordination mechanisms existing across levels of government for the design and implementation of NDCs, long-term low GHG emission development strategies (LT-LEDS) and subnational climate plans in three OECD countries (Canada, France and Germany) and a subnational government (State of California) in the United States.

Methodology

In this context, this paper examined the latest NDCs, LT-LEDS and subnational climate plans of Canada, France, Germany and the State of California of the United States, in order to identify co-ordination mechanisms across levels of government. The State of California was included in order to examine co-

ordination mechanisms specifically between local and regional governments. The analysis was based on desk research. The following guiding questions were used for the assessment, where possible:

- Emission reduction target: do national/state governments recognise the role of subnational governments (and other non-party stakeholders) to achieve the emission reduction targets set in their NDCs/LT-LEDS/subnational climate plans?
- Policy areas: do national/state governments identify policy areas where subnational governments have a prominent role to play in their NDCs/LT-LEDS/subnational climate plans?
- Mechanisms for policy alignment: do national/state governments have a mechanism to align national and subnational policies in their NDCs/LT-LEDS/subnational climate plans?
- Engagement: have subnational governments been consulted, or joined in the processes of developing NDCs/LT-LEDS/subnational climate plans?
- Supporting mechanisms: do national/subnational governments have instruments to support subnational climate actions (e.g., financing, technical assistance)?

Findings

The analysis shows that there are a variety of national initiatives which aim to co-ordinate and align subnational and local activities with national-level climate mitigation targets. The roles and responsibilities of cities and regions have been recognised in all the studied cases, and their climate actions have been explicitly incorporated in their respective NDCs, LT-LEDS and subnational climate plans.

Regarding NDCs, only Canada's NDC comprehensively takes into account the GHG emissions reduction estimate of subnational climate plans and actions, serving as an important model for other NDCs to apply. In the EU's NDC, for instance, neither subnational governments nor co-ordination across levels of governments are explicitly mentioned. No information was available, either, as to whether subnational governments have been consulted or given opportunities to give their opinion in the process of developing their NDC.

The lack of subnational government presence in NDCs is in a way anticipated, as the essential role of NDCs is to identify and communicate a country's climate targets under the framework of UNFCCC, and as it is not required for NDCs to define how to achieve the targets. However, it reveals an important concern if GHG emissions reduction targets set in NDCs may not have fully considered the potential contributions of local and regional governments. Given that there is a strong demand for more ambitious and transformative climate actions, it may be timely for national governments to fully integrate cities' and regions' achievements, progress and emission reduction potentials by setting up co-ordination mechanisms in developing and updating NDCs, and by formally stating the role of cities and regions in NDCs.

In contrast, this study also found that Canada, France, Germany and the State of California (United States) in fact have strong co-ordination mechanisms across levels of government in developing and implementing LT-LEDS and subnational climate plans. France and Germany have domestic climate action frameworks, which have closely engaged subnational governments and played key co-ordinating roles. The analysis of climate plans in the State of California (United States) highlights that regional governments within a country could also play an important role in linking their own climate actions with those of lower levels of governments. The present analysis found that several types of co-ordination mechanisms exist in the development and implementation of LT-LEDS and subnational climate plans, from which other countries or states could learn in order to improve the effectiveness of their multi-level co-ordination:

- **Joint development of climate plans**. While the national climate plan in Germany took into account the joint proposal of subnational governments, French regional climate plans were jointly developed by local, regional and national governments. Similarly, Canada's PCF was adopted by provincial governments and accounts for a range of subnational climate plans and actions.
- **Requirement for policy alignment**. In France, all levels of government are required to take the national climate strategy into account in their planning strategies. Similarly, local governments are charged with setting their own targets to reduce GHG emissions, as is the case in the State of California.
- **Setting up a joint committee**. France created a network of co-ordinated national, regional and local committees in implementing local climate plans. Similarly, in Germany, an alliance of various stakeholders including regional and local governments plays a key role in implementing climate policies. Canada's PCF serves as a strong basis for multi-level co-ordination.
- **Co-financing and financial incentives**. In Canada, the Ministry of Environment and Climate Change has pledged CAN 31.5 million for municipal green grants and loans to 20 cities or towns for projects to improve air, water and soil quality, including reducing carbon emissions (Canadian Press, 2016). In Germany, the National Climate Initiative (NKI) is the main source of funding for co-financing agreements between the federal government, the *Länder* and municipalities. Over 2008-2013, it invested EUR 421 million in over 19 000 projects domestically, of which 6 000 projects took place at the local level, involving 3 000 local authorities. In France, "Positive-Energy Territories" ("Les territoires à énergie positive") has provided grants for over 400 authorities in 2015 and 2016 (MEEM 2016a).

The summary and details of the findings from the case studies are respectively found in Table 3 and the following subsections.

Table 3. Multi-level co-ordination in the climate plans of Canada, France, Germany and State of California (US)

	Canada	France	Germany	State of California (US)
NDC, LT-LEDS or other national/state-level climate plan based on multi-level co-ordination	NDC (2017 revised submission) Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy	National Low-Carbon Strategy (SNBC) National Climate Change Adaptation Plan (PNACC-2)	Climate Action Plan 2050	The 2008 Climate Change Scoping Plan The First Update to the Climate Change Scoping Plan The 2017 Climate Change Scoping Plan
Link with subnational/local government	Pan-Canadian Framework on Clean Growth and Climate Change (2017) includes both national and subnational actions. Subnational climate actions are taken into account to achieve its target as an estimation of emissions reductions from provincial and territorial policies.	Subnational governments are legally required to account for SNBC in planning documents. SNBC proposes recommendations to improve governance tools for policy coherence, to develop synergies between levels of government, to localise indicators and to share data. PNACC-2 embeds a territorial approach through the creation of co-ordinated national, regional and local committees and	The *Länder* (federal states), municipalities, associations and citizens participated in the drafting of the Climate Action Plan 2050 through the submission of 97 proposals for strategic climate measures. The Climate Action Alliance (2015) consists of representatives from the *Länder* and	The 2008 Climate Change Scoping Plan charges local governments with setting their own targets to reduce GHG emissions. The state encourages local governments to create their own climate action plans to meet these targets, and provides regulation, funding and technical assistance to the local level.

		observatories, a data sharing platform, and a participatory knowledge-sharing platform, as well as assistance for the implementation of Local Climate-Air-Energy Plans.	municipalities, and supports the implementation of the Climate Action Plan 2050 at the local level.	

Note: The State of California is included to illustrate an example of effective co-ordination between local and regional governments.
Source: Author elaboration based on sources cited in below sections.

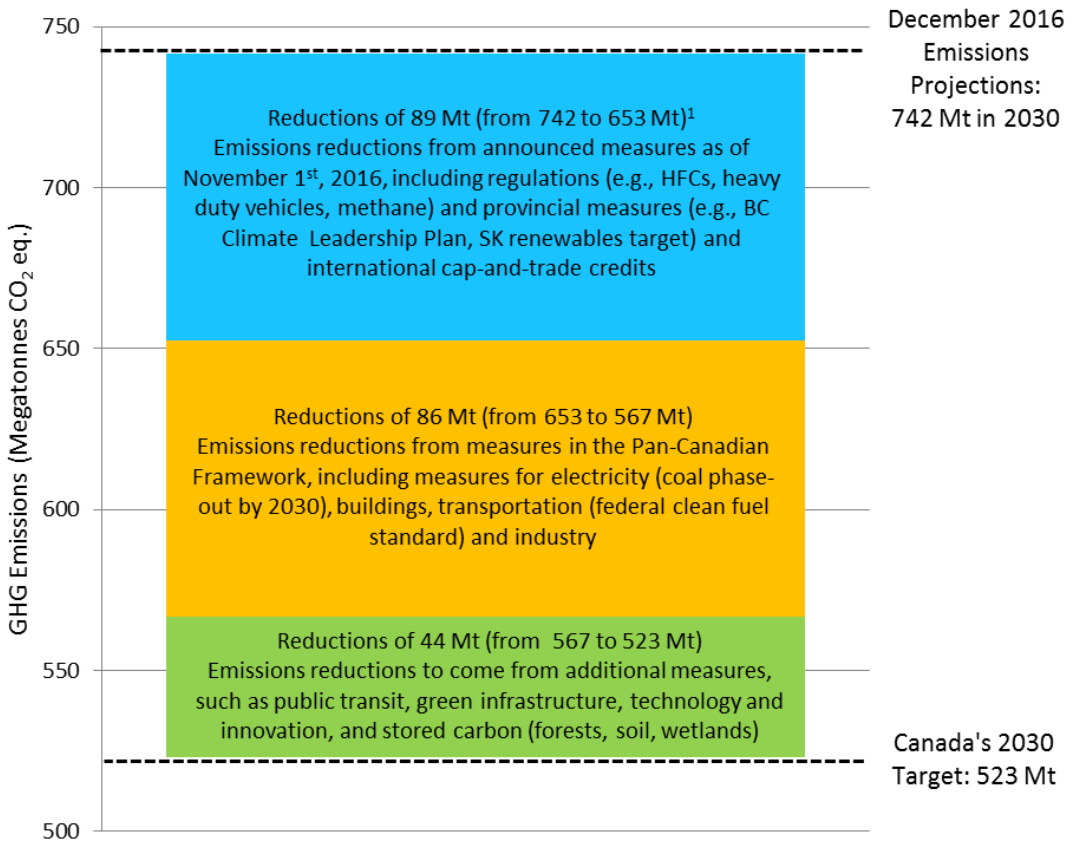
Canada

Canada's NDC and LT-LEDS, Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy, refer to the Pan-Canadian Framework (PCF), which was adopted by provincial governments. Moreover, provincial and territorial plans and actions from PCF are clearly indicated within the NDC, which include: protecting and enhancing carbon sinks including in forests, wetlands and agricultural lands; identifying opportunities to generate renewable fuel from waste; and demonstrating leadership by reducing emissions from government operations and scaling up the procurement of clean energy and technologies (Government of Canada, 2017). In this way, Canada's NDC takes into account an array of subnational climate plans and actions in its estimate of emissions reductions.

All federal, provincial and local mitigation measures that were announced as of 1 November 2016, were considered in the NDC's emissions reduction estimate. These measures in aggregate are projected to decrease Canada's emissions by 175 mega tonnes of CO_2e (Figure 1).[6] This includes the estimated impacts of carbon pricing, proposed regulations (e.g. clean fuel standards, accelerated coal phase-out, vehicle efficiency standards, regulations for methane and hydrofluorocarbons), and additional actions in electricity, buildings, transport and industry. The projected emission reductions do not assume that additional mitigation policies or measures would be implemented by the provinces and territories between now and 2030. Emissions reductions from additional future actions taken by other jurisdictions will be assessed if and when new measures are implemented. In this way, the kinds of measure, including provincial and territorial policies which constitute Canada's national target for emissions reductions, are clearly described in the NDC.

[6] "This estimate of 175 Mt does not include the full suite of commitments under the PCF. Specifically, the emission reductions associated with the unprecedented levels of investment in public transit, green infrastructure, innovation and clean technologies have not yet been estimated or modelled. Emissions reductions from these investments will be assessed and quantified as specific projects are identified and as programs are implemented. Additionally the potential increases in stored carbon (carbon sequestration) in forests, soils and wetlands have not been included in the projected emissions reductions figure of 175 Mt. For a country such as Canada, carbon sequestration could make an important contribution to the achievement of the 2030 target" (Government of Canada, 2017).

Figure 1. Emissions reductions from the Pan-Canadian Framework



Note: Reductions from carbon pricing are built into the different elements depending on whether they are implemented, announced, or included in the Pan-Canadian Framework. The path forward on pricing will be determined by the review to be completed by early 2022.

1. Estimates assume purchase of carbon allowance (credits) from California by regulated entities under Quebec and Ontario's cap-and-trade system that are or will be linked through the Western Climate Initiative.

Source: Government of Canada (2017).

France

Although neither the EU's NDC nor France's complement to the NDC specifically address multi-level co-ordination, France has elaborated two national-level climate change strategies – one for mitigation, the other for adaptation – which seek to ensure policy coherence between levels of government. In 2010, France passed a law (n° 2010-788) which facilitates national and regional collaboration by including representatives of the national government and national agencies, as well as the individual regions, in the development of climate plans. As a result, by 2014, all regions had established Regional Climate-Air-Energy Plans (SRCAE) that are jointly developed by the National Environment and Energy Management Agency (ADEME), regional prefectures, regional councils, local authorities and stakeholders (Ministère de l'Écologie, 2014). As stipulated by the 2015 law on the energy transition for green growth (law n° 2015-992), in 2019 the SRCAE will be integrated into the broader scope of the Regional Plans for Urban Planning, Sustainable Development and Territorial Cohesion (SRADDET) and will remain co-designed across levels of government (ONERC, 2017). The co-ordination arrangement provided by the SRADDET

allows national and regional dialogues and facilitates policy alignment, while at the same time functioning as a technical assistance mechanism.

The French Ministry for the ecological and solidary transition (MTES) launched the country's newest national-level mitigation strategy in July 2017, the Climate Plan (*Plan Climat*), which has a goal to reach carbon neutrality (net zero emissions) by 2050. The Climate Plan aims to achieve this goal primarily through its LT-LEDS, the 2015 National Low-Carbon Strategy (SNBC), which defines the roadmap that all levels of government are legally required take into account in their respective planning strategies (Article 222-1 B, Code de l'environnement), backed by a law enacted in 2015 (law n° 2015-991) which devolves greater power to territories (Aguilar-Jaber et al., forthcoming). The planning strategies include the SRADDET among numerous other regional, territorial, and urban strategies.[7] Future evaluations will be undertaken in order to assess the extent to which these strategies are adequately correlated with the SNBC in practice (MTES, 2018a).

The SNBC was the product of a participatory process benefiting from concertation with France's Expert Committee on the Energy Transition and with citizens via public debates and online questionnaires, as well as with a range of stakeholders following six meetings of a dedicated Steering Committee (*Comité d'Information et d'orientation*) and the reflections of its seven working groups (MTES, 2018b). Recognizing that subnational levels of government play a major role in implementing the shift to a low-carbon economy, the SNBC recommends the elaboration of governance tools that would: reinforce the coherence of different qualitative objectives in a progressive and iterative manner between different levels of government; develop synergies between subnational stakeholders; broaden co-ordination among local governments who have developed Local Climate-Air-Energy Plans through the sharing of data; integrate national-level SNBC monitoring indicators at the local level (MTES, 2018b).

France's second National Climate Change Adaptation Plan (PNACC-2) has markedly improved multi-level policy coherence as compared to its predecessor, the 2011-2015 National Climate Change Adaptation Plan (PNACC-1). A comprehensive review conducted by the State's National Observatory on the Effects of Climate Change (ONERC), revealed that PNACC-1 failed to link multi-level climate adaptation policies since it generated tools, methods and information that were primarily pertinent for the national-level (ONERC, 2017), In response to this, PNACC-2 has incorporated a territorial approach to reinforce multi-level co-ordination, based on ONERC's recommendations and a year-long national consultation with 300 participants (MTES, 2018d). This approach notably consists in the creation of a network of co-ordinated national, regional and local committees and observatories whose mandate will be to: assist in the implementation of Local Climate-Air-Energy Plans; establish a platform for the collection and dissemination of localised data; and serve as a participatory, knowledge-sharing platform (ONERC, 2018). Mitigation measures included in PNACC-2 will also be integrated in the SNBC to ensure coherence between France's two-national-level climate action plans (MTES, 2018c). However, unlike the SNBC, subnational planning strategies are not uniformly required to take into account the PNACC-2, resulting in a relative lack of adaptation measures in these strategies, which signals a potential obstacle to PNACC-2's implementation at the local level (ONERC, 2018).

[7] The Regional Plans for Biomass (*Schéma régional biomasse*), the Regional Programmes for Woods and Forests (*Programme régional forêt bois*), urban-level Territorial Coherence Plans (*Schéma de coherence territoriale*), local-level Plans for Urban Planning (*Plan local d'urbanisme et plan local d'urbanisme intercommunal*), Plans for Urban Mobility (*Plan de déplacement urbain*), Territorial Plans for Climate Air Energy (*Plan climat-air-énergie territorial*), local-level Plans for Atmospheric Protection (*Plan de protection de l'atmosphère*).

Germany

Although the EU's NDC does not specifically address multi-level co-ordination, subnational governments in Germany have played an active role in the *Climate Action Plan 2050*, Germany's LT-LEDS submitted under the framework of the Paris Agreement in November 2016. The *Länder* (federal states), municipalities, associations and 500 randomly selected citizens compiled a citizens report, outlining joint proposals for strategic climate measures to be effective by 2030. They presented the resulting catalogue containing 97 proposals for measures to the Federal Environment Minister. In drafting the *Climate Action Plan 2050*, the German government considered this catalogue alongside the findings of scientific reports and scenarios in light of the Paris Agreement (BMUB, 2016). In fact, 52 out of the 97 strategic measures proposed by the participants were adopted in the final version of the LT-LEDS (Aguilar-Jaber et al., forthcoming).

In addition to the planning process, the German government promoted broad participation including from the *Länder* and local authorities in the implementation and reviewing processes of the *Climate Action Plan 2050*. Recognizing the importance of active involvement at the regional and local levels for climate action, it created the *Climate Action Alliance* in 2015, made up of diverse stakeholders, including the *Länder* and local authorities. The *Climate Action Alliance* supports the implementation of the programmes and measures for the *Climate Action Plan 2050*. The plan will be reviewed and updated as part of a public dialogue process with broad participation from the *Länder*, local authorities and other stakeholders who will continue to participate in the Climate Action Alliance to ensure continuous monitoring (BMUB, 2016).

The German government has also established several co-ordination mechanisms between national and subnational governments in specific climate-related policies. While co-ordinating with the *Länder* on regulatory changes such as giving local authorities more power to set speed limits for increasing both vehicle energy efficiency and traffic safety, the federal government started to cooperate with subnational governments to promote sustainable procurement process and common agricultural policy (BMUB, 2014b).

State of California, United States

The State of California (US) has distinguished itself internationally as a subnational government leading action to reduce GHG emissions. Unlike national governments, California does not report its GHG emissions reductions targets and plans to the United Nations. However, the state set ambitious climate goals in the California Global Warming Solutions Act of 2006 (Assembly Bill 32 or AB 32) to reduce emissions to 1990 levels by 2020. In April 2015, these targets were increased to 40% below 1990 levels by 2030 (California ARB, 2019).

Rather than examining the national-subnational relationship and comparing it to other countries, this case study will focus on the relationship and co-ordination mechanism between the State of California and local governments within its borders. The state's primary mechanisms for reducing GHG emissions at the local level are through regulations setting emissions reduction targets, support for local climate mitigation plans to meet those targets, and funding mechanisms aligned with those plans.

The 2008 Climate Change Scoping Plan, which implemented AB32, charged local governments with setting their own targets to reduce GHG emissions by 15% below 2008 levels. Local governments were encouraged by the state to create their own climate action plans to meet these targets, with the state's support. To meet California's 2020 and 2030 emissions targets through local government action, the state created regulations, incentives, funding mechanisms and a cap-and-trade system (California ARB, 2016a). AB 32 required the Climate Change Scoping Plan to be updated every five years (the first update was

approved in 2014), which allows the state to assess the impact of investment mechanisms and to revise them (California ARB, 2014).

The First Update to the Climate Change Scoping Plan emphasised the need for regulations that guide climate investments to be complementary and to integrate planning objectives to make the most of limited resources for investments. For example, the update explicitly identifies opportunities for co-ordinating policies in the water and energy sectors to cut emissions from water distribution, and in the freight and passenger transport sectors (State of California, 2014). The updated 2017 Climate Change Scoping Plan was approved to meet the targets of a 40% reduction in GHG emissions by 2030 relative to a 1990 baseline.

The state provides technical assistance for local governments to meet their state-mandated targets through the creation of local or district climate plans. The California Air Resources Board collaborated with other state agencies and academic institutions to produce a Local Government Toolkit to help with inventorying emissions and developing a plan to reduce them (CoolCalifornia.org, n.d.). In addition, in 2017 the California Air Resources Board appointed its first Environmental Justice Liaison, whose role will be central in advising climate policies and ensuring that California residents are not left behind. Co-financing is California's main means of state-local co-ordination and investments, primarily funded by the state's cap-and-trade programme. Indeed, state strategies specifically identify actions that local governments can take to support them, and funding aligns with those strategies (California Climate Investments Map, n.d.).

Insights for further research

Despite the overall lack of reference to multi-level co-ordination in the case studies of NDCs, each country has in fact developed strong co-ordination mechanisms between levels of government for the implementation of climate action, as detailed in the preceding subsections and summarised in Table 3.

While these national supporting mechanisms have certainly facilitated subnational climate action, it was not clear from available information for this analysis how the impacts of such subnational actions on the national emission reductions have been monitored and evaluated, and whether they have been incorporated into NDC targets.

Although the number of countries/states is limited in the present study, the above analysis provides several key insights for further research:

- National-subnational co-ordination is not commonly observed in current NDCs, although Canada recognises the role of subnational governments and take such co-ordination into account in its NDCs. A main concern is that emission reduction targets in NDCs may not fully reflect subnational climate action.
- Canada's NDC is instrumental, in that all the federal, provincial and local measures for emissions reductions which have been announced (at the time of the policy formation) are considered in the emission reduction estimation in its NDC. Better understanding of the details of how Canada addressed and overcame political, administrative and technical barriers (e.g. double-counting, ensured commitment of different subnational actors) may provide further valuable insight.
- As is observed in France's and Germany's LT-LEDS and domestic climate action frameworks, a variety of mechanisms exist to co-ordinate and align national and subnational climate policies and strategies. Further analysis of effectiveness of these mechanisms would provide useful insights.

- The current co-ordination efforts in federal countries may present a workable model of how national and subnational levels can work together. In federal states, mitigation action is often undertaken at the subnational level with co-ordination at the central level.
- The role that regional governments (states, provinces) can play may not have been well articulated and merits further investigation. Canada's provinces and territories have developed their own climate change plans and strategies. The State of California has demonstrated its capacity in co-ordinating within levels of subnational government (i.e. states and municipalities) and in supporting local governments.
- While national support to subnational government in the form of financial and technical assistance is much more commonly observed, monitoring and evaluating the impacts of these measures on emissions reductions can allow for a more effective and co-ordinated approach. Indeed, globally, many assessments quantifying national and subnational GHG emissions reduction are not always aligned in terms of their assumptions, data and methodologies (UNEP, 2018; Hsu et al., 2019a).
- There is an important need for further evidence-based research on the role of non-governmental stakeholders (e.g., local communities, citizens, the private sector, etc.) in climate action and how governments can integrate their climate action into national and subnational climate plans and strategies.

4 Assessing multi-level investment for climate mitigation

Meeting the targets of Nationally Determined Contributions (NDCs) and long-term low GHG emission development strategies (LT-LEDS) requires each country to specify how they will achieve their emissions reductions, which often involve significant public investment. In this regard, this section offers a systematic analysis of climate mitigation investment against a set of OECD standards on subnational investment.

Cities and regions are key financial, investment and policy actors in the transition towards a low-carbon economy. Subnational governments are major spenders and investors: their budgets account for an increasing share of public expenditures, carrying out 40% of total public spending and 57% of public investment in the OECD in 2016. Globally, subnational governments represented 24% of public spending and 39% of public investment in 2013 (OECD/UCLG, 2016). Subnational governments are responsible for a large share of climate-related spending and investment. In a sample of 30 OECD countries, it is estimated that 64% of environmental and climate-related investment was performed by subnational governments over the period 2000-2016 (OECD, 2019d). In just under a third of the countries, 70% or more of climate-related spending occurred at the subnational level (OECD, 2019d). Further, many of the domains that fall under the jurisdiction of cities – land use planning, zoning, water provision, sanitation and drainage, housing construction, urban renovation, regulation, economic development, public health and emergency management, transport, environmental protection – are directly vulnerable to climate change impacts, but also represent opportunities to develop adaptive capacities and strategies (Hallegatte et al., 2016). Cities and regions/states are developing a range of financial strategies to meet these needs.

The *OECD Council Recommendation on Effective Public Investment Across Levels of Government* arose out of the recognition that a large volume of total public investment in the OECD is undertaken by subnational governments which require significant co-ordination and capacities to handle this investment properly, and that both national and subnational governments are under pressure to do more with fewer resources (OECD, 2014; Allain-Dupré et al., 2017) (Box 3).

As the OECD continues to support member countries in meeting their NDC and LT-LEDS commitments to reduce GHG emissions, it is useful to consider how the OECD Principles can guide the deployment of public climate investment at the subnational level. A first step in this process is to gain an understanding of the nature, scale and forms of the governance of public investment related to climate mitigation and adaptation policies and the degree to which these activities align with the OECD Principles.

Box 3. OECD Recommendation on Effective Public Investment Across Levels of Government

In 2014, the OECD has adopted the Recommendation on Effective Public Investment Across Levels of Government. An OECD Recommendation is an OECD instrument adopted by the OECD Council. Recommendations are not legally binding, but practice accords them great moral force as representing the political will of Member states. Subnational governments, defined as federated states, regions and other municipalities, undertook 57% of total public investment in 2016 across the OECD area in terms of volume. Effective public investment requires substantial co-ordination across levels of government to bridge information, policy or fiscal gaps that may occur, as well as critical governance capacities at different levels to design and implement public investment projects.

The purpose of these Principles is to help governments assess the strengths and weaknesses of their public investment capacity in a multi-level governance perspective and set priorities for improvement. An Implementation Toolkit provides guidance with details for all countries (available at: **http://www.oecd.org/effective-public-investment-toolkit/**).

OECD Recommendation from the Council, adopted on March 12 2014

OECD Member countries should take steps to ensure that national and subnational levels of government effectively utilise resources dedicated to public investment for territorial development in accordance with the Principles set out below:

Pillar I: Co-ordinate public investment across levels of government and policies.

- Invest using an integrated strategy tailored to different places.
- Adopt effective co-ordination instruments across national and subnational governments.
- Co-ordinate among subnational governments to invest at the relevant scale

Pillar II: Strengthen capacities for public investment and promote policy learning across levels of government.

- Assess upfront long-term impacts and risks of public investment.
- Encourage stakeholder involvement throughout the investment cycle.
- Mobilise private actors and financing institutions to diversify sources of funding and strengthen capacities.
- Reinforce the expertise of public officials and institutions throughout the investment cycle.
- Focus on results and promote learning.

Pillar III: Ensure sound framework conditions for public investment at all levels of government

- Develop a fiscal framework adapted to the investment objectives pursued.
- Require sound, transparent financial management.
- Promote transparency and strategic use of public procurement at all levels of government.
- Strive for quality and consistency in regulatory systems across levels of government.

Source: OECD (2014).

Methodology

Reflecting the analysis in the previous section, for Canada, France, Germany and the State of California (US) policies related to climate mitigation investment that are co-ordinated or implemented at the subnational level were organised into the following categories: co-financing instruments; financial incentives; regulations supporting and facilitating subnational investment; platforms of dialogue and technical assistance; and procurement. The policies and programmes in each category were then compared to the OECD Principles, and the principles that aligned with those activities were identified. The indicators listed in Table 4 were used when assessing the alignment with each principle. These indicators were chosen because either they were observed in activities in the three countries and the state or they would most directly contribute to the quality of climate investments. The findings from this exercise are summarised in Table 5 and Table 6.

Table 4. List of the most-applicable indicators for each principle

Principles	Key elements
	Pillar I: Co-ordinate public investment across levels of government & policies
1. Invest using an integrated strategy tailored to different places.	Mechanisms exist to ensure that subnational investment plans reflect national and subnational development goals Complementarities between investments in hard and soft infrastructure Data available and used to support the territorial assessment and planning processes
2. Adopt effective instruments for co-ordinating across national and subnational levels of government.	There should be communication pathways between national and subnational governments (be it on financing instruments, programme design, resource allocation, etc.) Trust among different levels of government Co-financing arrangements for public investment exists
3. Co-ordinate horizontally among subnational governments to invest at the relevant scale.	Economies of scale should exist Synergies between neighbouring or other subnational governments
	Pillar II: Strengthen capacities for public investment & promote policy learning at all levels of government
4. Assess upfront the long-term impacts and risks of public investment.	Ex ante assessments Long-term operational and maintenance costs should be assessed from the early stages of the investment decision Long-term risks and impacts should be identified
5. Engage with stakeholders throughout the investment cycle.	Mechanisms exist to identify and involve stakeholders throughout the investment cycle Involvement of public, private and civil society stakeholders Consultation processes should be inclusive, open and transparent Feedback from stakeholders is integrated into investment decisions and evaluation
6. Mobilise private actors and financing institutions to diversify sources of funding and strengthen capacities.	Financing institutions should offer more than just financing (e.g. capacity building of the government) Co-ordination between national and city and level on the development of financial channels for low-carbon infrastructure investment Diversification of financing mechanisms (PPP, land-value capture, equity funds, institutional investors) Establishment of green financial centres
7. Reinforce the expertise of public officials and institutions involved in public investment.	Cultivate human resources management, knowledge and relationships that ultimately help to improve capacity of officials Technical assistance should be provided
8. Focus on results and promote learning from experience.	Outcomes to be achieved must be clearly identified from the outset Through evaluations, performance information contributes to inform decision-making at

	different stages of the investment cycle
Pillar III: Ensure proper framework conditions for public investment at all levels of government	
9. Develop a fiscal framework adapted to the investment objectives pursued.	Intergovernmental fiscal framework is clear, with timely indications of transfers between levels of government Grants and co-financing instruments should be present Enabling conditions for subnational governments to exploit their own revenue raising potential
10. Require sound and transparent financial management at all levels of government.	Budgeting and financial accountability should be conducted for the medium- and long-term
11. Promote transparency and strategic use of public procurement at all levels of government.	All stages of the procurement cycle should be transparent, competitive and monitored Objectives of the procurement should be clearly defined
12. Strive for quality and consistency in regulatory systems across levels of government.	Public consultations are conducted in connection with the preparation of new regulations of sufficient duration, accessibility and appropriately targeted There should be consistency across sectors and levels of government in national and local policies and targets

Findings

The review of the subnational climate investment activities by the three countries and the state provides a preliminary indication of how the OECD Principles apply to investments to reduce GHG emissions.

Table 5 presents the specific principles that are relevant to each of the three countries and the state, clearly showing that some principles are more easily achieved and applied in each case study (Principles 1, 2, 5 and 9) while some principles are completely (Principle 4) or almost completely absent (Principles 3, 8 and 10). Table 6 provides details on the climate activities in each country and state and how they reflect individual OECD Principles, with the help of the indicators described in Table 4.

Table 5. The degree of relevance of each OECD Principle to subnational climate investments

Case Study	Principles											
	Co-ordinate public investment across levels of government & policies			*Strengthen capacities for public investment & promote policy learning at all levels of government*					*Ensure proper framework conditions for public investment at all levels of government*			
	1	2	3	4	5	6	7	8	9	10	11	12
Canada	✓	✓	✓		✓				✓			
France	✓	✓			✓		✓		✓		✓	✓
Germany	✓	✓			✓	✓	✓		✓		✓	✓
State of California (US)	✓	✓			✓	✓	✓	✓	✓		✓	✓

Note: ✓ refers to the Principles which are found to be applied in the studied countries/state.

Based on the selected country and state cases, several principles were found to have been applied more regularly than others. Across the three pillars of the Principles, some principles were more relevant than others. Principles 1, 2, 5, and 9 were observed in all the three countries and the state, while Principles 7, 11 and 12 were found in France, Germany and the State of California. These findings indicate there may

be a growing recognition among national governments of the importance of aligning climate investments with climate policies at subnational levels of government and providing needed capacity.

Among the selected examples, national or state governments are seeking to integrate their climate plans with regional or local planning processes, with co-ordination across levels of government being inherent to most subnational climate investments, therefore displaying recognition of the localised nature of efforts to reduce emissions. For example, applying **Principle 1 on investing using an integrated strategy tailored to different places** to climate mitigation financing, it was observed in all 4 cases that state or national funding programmes and planning are explicitly tailored to local needs and contexts. In the state of California (US), local plans are employed to achieve state targets; in Canada, the Ministry of Environment and Climate Change has made monetary pledges to cities and towns, in the form of grants and loans, in order for them to pursue climate-related investments; in France, as many as 400 local authorities have received grants to fund their respective climate mitigation policies; and in Germany, funding is aligned with local needs.

Principle 2 on adopting effective instruments for co-ordinating across national and subnational levels of government was also relevant in all the cases. Co-ordination between national, regional and local governments varied in form – some focused more on dialogue, some more on integrated plans and others focused on contracts (Box 4). In France, for example, national and local authorities work together to implement grant programmes, and dialogue mechanisms exist that help in programme implementation. Canada was the single case study where **Principle 3 on horizontal co-ordination among subnational governments to invest at the relevant scale** was applicable. In Canada, horizontal co-ordination among subnational governments existed in the form of provincial governments entering agreements with other provincial governments through platforms of dialogue. There seems to be limited formal horizontal co-ordination across subnational governments on climate investments, perhaps due in part to the tendency of higher levels of government to finance state/regional and local governments directly (vertical co-ordination). There is little financial incentive for co-ordinating climate investments across subnational governments unless this is a condition of financing. Memoranda of Understanding do exist among some subnational governments (e.g. in Canada) but these involve co-ordinating the use of provincial/regional resources rather than co-ordinating the deployment of national funds.

Box 4. Vertical co-ordination: the Vancouver Declaration

The Vancouver Declaration provided a set of commitments to address climate change. These included fostering investment in clean technologies, adapting carbon pricing mechanisms to each province's and territory's needs, sharing information to favour low-carbon technologies, and strengthening intergovernmental cooperation on climate change through the Councils of Minsters of the Environment, Ministers of Finance, Ministers of Innovation and Economic Development, and Ministers of Energy. Participation of indigenous and civil-stakeholders was also emphasised. The Canadian Prime Ministers and Premiers agreed to jointly develop the Pan-Canadian Framework on Clean Growth and Climate Change (Canadian Intergovernmental Conference Secretariat, 2016; Government of Canada, 2016a).

The long-standing Council of Ministers of the Environment is the main intergovernmental body for federal, provincial and territorial ministers to collaborate on environmental issues. In July 2015, the Council launched a Climate Change Committee to lead the Council's work program on climate change (Government of Canada, 2016b). While this co-ordinating body is in its early stages, both it and the

Vancouver Declaration embody Principle 2 in that they are instruments for co-ordinating efforts to reduce GHG emissions - including public investment - across national and subnational levels of government.

Source: Canadian Intergovernmental Conference Secretariat (2016); Government of Canada (2016a); Government of Canada (2016b).

Alarmingly, no countries/state studied seemed to employ **Principle 4** – **assess upfront the long-term impacts and risks of public investment**. There is no evidence of *ex-ante* assessment of climate investment risks, perhaps due to the fact that many of the impacts of climate investments are difficult to quantify and are felt at a global rather than local scale.

In all the three countries and the state, a wide range of stakeholders were involved in designing and implementing climate policies, including representatives of regional and local authorities as well as representatives of civil society and indigenous groups. This corresponds to **Principle 5 on engaging with stakeholders** throughout the investment cycle. Climate plans and programmes in all four case study governments recognised the need to involve a wide range of stakeholders in order to achieve the economic, social and environmental objectives inherent to many of the subnational climate investments. It is also important to recognise the non-monetary nature of many of the benefits of climate investment. Regarding **Principle 6 on mobilising private actors and financing institutions to diversify sources of funding and strengthen capacities**, programmes to reduce emissions by the private sector and individuals are found in California and Germany.

Relating to **Principle 7 on reinforcing the expertise of public officials and institutions involved in public investment**, technical assistance for climate investments by national or state governments to regional or local authorities was common in all cases, except in Canada where the federal government's climate policy is still under development. Where technical assistance and capacity building existed, this was provided by means of support by national or state governments to regional or local authorities (Box 5). This support could also take the form of data on climate impacts and the benefits of greenhouse emissions reduction activities; of capacity building; and of convening dialogues to share best practices. **Principle 8** – **focus on results and promote learning from experience** – was only relevant to California and was absent in Canada, France and Germany.

Box 5. Subnational capacity building in Germany

Technical assistance and information support account for many of the initiatives in the Climate Action Programme 2020 that involve subnational governments. Most notably, municipalities can apply for funding from BMUMB to subsidise the costs for three years of hiring a climate manager to implement a climate strategy (two years for a sub-strategy), and this funding can be extended in the case of follow-up projects (BMUB, 2015). In addition, the federal government supports the *Länder*, local authorities and other public agencies in the drafting of plans for energy-efficiency refurbishment, and supports the implementation of the federal Assessment System for Sustainable Building (BNB) at these subnational levels. The National Action Plan for Energy Efficiency includes providing energy advice to local authorities, and a federal project to support the use of low-energy light-emitting diodes (LEDs) works with local authorities and industry to provide guidelines and increase the use of LED technologies. The federal government also provides information to encourage the stabilisation of landfills to reduce their GHG emissions (BMUB, 2014b).

Source: BMUB (2015); BMUB (2014b).

Principle 9 – **develop a fiscal framework adapted to the investment objectives pursued** – was relevant to all the three countries and the state, perhaps owing to the incentive for subnational governments to develop fiscal frameworks in order to secure funding for their respective climate mitigation investments. With a wide range of stakeholders involved, co-financing ensures their commitment to the success of a project. A range of co-financing mechanisms were applied, including grants, subsidised loans and financial incentives. Grants were the most common financing mechanisms across all the three countries and the state. **Principle 11 on transparency and strategic use of public procurement at all levels of government** applied to all the three countries and the state except in Canada. Procurement was integrated into most climate subnational investments but was more focused using procurement strategically to achieve climate goals rather than on increasing the transparency of procurement. Similarly, **Principle 12 was relevant to all the three countries and the state except Canada**. National and state governments created regulations that encouraged or required lower levels of government to align their policies and plans with national/state climate goals, thereby achieving quality and consistency in regulatory systems across levels of government. Within pillar 3, **Principle 10 was only relevant to the state of California (US)**, where there was the largest and most readily accessible information on how public climate investments are spent at lower levels of government. Information on monetary amount of grants to local authorities appeared on Canadian, French and German webpages but in a far less systematic way.

Applying the OECD principles in climate change mitigation policies, several principles have more relevance than others:

- Climate mitigation investments need to be tailored to the place the investments aim to serve (Principle 1), supported by the growing recognition of the importance of a city as a site to address climate change issues (Bulkeley, 2010).
- Principle 2 on co-ordination across national and subnational levels of government is also critical, as co-ordination is necessary to identify investment opportunities and bottlenecks. Subnational and/or local governments are more likely to be able to identify specific problems than national governments due to the varying severity and nature of climate change impacts, therefore climate mitigation financing can be more effective when tailored to local contexts.
- Since climate mitigation investments are long-term investments, long-term operational and maintenance costs must be identified and assessed from the outset (Principle 4). With cities as highly dynamic spaces constantly undergoing changes, risk assessments must be undertaken throughout the investment process and risks should be re-evaluated whenever new information becomes available.
- Principle 7 on reinforcing the expertise of public officials and institutions involved in public investment as well was Principle 8 on having a focus on results and promoting learning from experience are highly relevant; subnational governments could be “pioneers in policy initiation and implementation” as states may develop new problem-solving solutions autonomously and experiment with their implementation before these solutions are scaled up to the national level, or serve as a model for other states (Jorgensen et al., 2015).
- Subnational governments should also be able to exploit their own revenue raising potential (Principle 9) such that investments can be financed in the long-term. The fact that local governments are recognized as more than just observers and have indeed become “influential actors” in the UNFCCC process necessitates that subnational and national governments need to work closely together and ensure that policies are aligned.

- As such, quality and consistency in regulatory systems across levels of government (Principle 12) is key, and this can help to avoid costly duplication of policies.

Table 6. A preliminary assessment of how the OECD Principles apply to climate investment in the three countries and the state

Principles	Canada	France	Germany	State of California (US)
Pillar I: Co-ordinate public investment across levels of government and policies				
1. Invest using an integrated strategy tailored to different places.	Federal government is funding 20 municipalities for climate-related investments tailored to their contexts.	Grants are awarded to local authorities based on their applications for funding under the "Positive-Energy Territories" programme	Regional and local authorities align funding (e.g. for public transport) with local needs.	Local authorities are encouraged to develop climate plans and additional targets tailored to their communities. Complementarities between sectors were identified in first five-year update of state climate plan.
2. Adopt effective instruments for co-ordinating across national and subnational levels of government.	The Council of Ministers of the Environment is the main federal-provincial co-ordinating body on climate change. It provides a foundation for a pan-Canadian Framework on clean growth and climate change.	National and local authorities co-ordinate in the implementation of grant programmes, and dialogue mechanisms exist to support programme implementation.	The national government deploys funding through the *Länder*, mainly through co-financing agreements. A number of dialogue mechanisms also exist.	State and local governments co-ordinate on the development of local climate and sustainable communities plans, which are intended to contribute to state policy goals. Local authorities are involved with designing programmes and setting criteria for allocating state cap-and-trade funding.
3. Co-ordinate horizontally among subnational governments to invest at the relevant scale.	Provincial governments have entered into agreements or memoranda of understanding with other provincial governments, including on electrical grid improvement and cap-and-trade mechanisms.	n.a.	n.a.	n.a.
Pillar II: Strengthen capacities for public investment and promote policy learning at all levels of government				
4. Assess upfront the long-term impacts and risks of public investment.	n.a.	n.a.	n.a.	n.a.
5. Engage with stakeholders throughout the investment cycle.	The 2016 Vancouver Declaration by the Prime Minister and provincial Premiers calls for engaging indigenous communities and the public at large in developing a pan-Canadian framework on clean growth and climate change.	Grant programmes and joint planning mechanisms involve local, regional and national stakeholders.	Public dialogue processes inform the national climate programme. The federal government has asked *Länder*, local governments and civil society to share their climate projects so that these also may be included national climate programme documents.	Stakeholders are heavily involved in the development and update of state Climate Scoping Plans and in informing the allocation of cap-and-trade funds.
6. Mobilise private actors and financing institutions to diversify sources of funding and	n.a.	n.a.	Incentive mechanisms exist for corporate mobility programmes and industrial energy-efficiency	Some state programmes supported local agencies to co-ordinate with the private sector to reduce emissions, but most programmes with the private sector were run directly at the state level.

strengthen capacities.				
7. Reinforce the expertise of public officials and institutions involved in public investment.	n.a.	Technical assistance features prominently in subnational grant-making and planning activities funded by the national government.	The federal government provides numerous technical assistance and information mechanisms to the *Länder* and local governments. This includes a programme that funds municipalities to hire a Climate Manager.	State agencies support the development of local climate and sustainable communities strategies. Technical resources include emissions inventorying and a database on funding sources local governments can apply to.
8. Focus on results and promote learning from experience.	n.a.	n.a.	n.a.	The California Climate Scoping Plan is required to be assessed and updated every five years.
Pillar III: Ensure proper framework conditions for public investment at all levels of government				
9. Develop a fiscal framework adapted to the investment objectives pursued.	Low Carbon Economy Fund is developed to support new provincial and territorial actions. Separately, grants and loans were provided by the federal government to 20 cities or towns for environmental projects, including reducing carbon emissions.	Funding takes the form of grants to regional or local authorities.	Co-financing is the main type of funding, and most comes from the National Climate Initiative (NKI).	A wide range of funding mechanisms exist to meet climate mitigation targets, including through grants, loans and incentives. Their primary source is revenue generated by the state's cap-and-trade programme.
10. Require sound and transparent financial management at all levels of government.	n.a.	n.a.	n.a.	The state makes available extensive information on where cap-and-trade funding has been allocated, including amounts, project type and project location.
11. Promote transparency and strategic use of public procurement at all levels of government.	n.a.	The national government sets requirements and provides support for subnational governments to purchase low-emission transport, building and lighting technologies.	The federal government fosters low-carbon subnational procurement practices. Federal government, *Länder* and local authorities have been working together in an alliance for sustainable procurement since 2010.	The state provides grants to local educational authorities to procure energy-efficiency technologies and support clean energy projects, which is funded through Proposition 39, a state-level referendum. Grants funded by the cap-and-trade mechanism are also provided to local transportation authorities to increase the energy-efficiency of local fleets.
12. Strive for quality and consistency in regulatory systems across levels of government.	n.a.	Grant programs are part of a package of regulations that together represent a co-ordinated effort to transition away from fossil fuels.	The national climate programme includes regulatory reform to align sectoral policies with climate goals at the national and *Länder* levels.	State regulations and targets are devolved into local targets through local climate plans and regional sustainable communities strategies.

Insights for further research

Building on these findings, the following policy questions are identified for future investigation and research:

- To what degree are climate plans integrated across levels of government and how do such plans inform subnational climate investment decisions?

- How are programmes selected for funding by the responsible level of government? How are the criteria for selection developed?
- What mix of grants, taxes, external funding, including private investment, makes up countries' sources of climate funding to subnational governments?
- Are data available on the initial impacts of subnational climate investments, in terms of the cost of abatement of tonnes of CO_2 equivalent? While most climate plans and investments have a monitoring, reporting and verification element, in many cases it is too early to quantify their impact in terms of avoided carbon emissions.
- Are countries with the highest share of subnational climate investment also those with the most developed mechanisms for supporting the multi-level governance of climate investments, or are these activities occurring in the absence of such mechanisms?
- How should horizontal cooperation across subnational governments on climate investments be further strengthened?
- What oversight mechanisms exist to monitor subnational climate investments and evaluate their impact?

5 Conclusion

This paper argued that the development and implementation processes of Nationally Determined Contributions (NDCs) and long-term low GHG emission development strategies (LT-LEDs) provide an opportunity to develop an integrated approach to implement the Paris Agreement by aligning and co-ordinating national and subnational climate policies, strategies and investment. It highlights that, as the complementary role of different levels of government in climate action has been well recognised, there is growing momentum for national governments to design and implement a national policy framework that is conducive to subnational actions and to ensure that the diversity of local and regional responses are aligned with national strategies and commitments.

The two pilot analyses conducted in the paper revealed the diversity of efforts regarding how subnational and local activities co-ordinate and align with national-level policies, strategies and investment. First, the analysis of the three countries and the state cases on their NDCs, LT-LEDS and subnational climate plans showed that, while NDCs rarely document the role of subnational governments, domestic climate action frameworks have closely engaged subnational governments and played key co-ordinating roles. Four types of co-ordination mechanisms are identified: joint action (e.g. development of climate plans and strategies), regulatory frameworks (e.g. requiring policy alignment), dialogues (e.g. joint committees), and fiscal instruments (e.g. co-financing and financial incentives). Given that most countries are currently updating their NDCs and LT-LEDS as the implementation guidelines of the Paris Agreement are put in place, there is a strong opportunity for national governments to discuss with cities and regions, taking into account cities' and regions' achievements, progress and potential in a more systematic manner and incorporating them into NDCs and LT-LEDS.

Second, the review of three national practices and one subnational practice on climate mitigation investment, using the analytical framework of the OECD Principles on Effective Public Investment Across Levels of Government, showed that co-ordination across levels of government was inherent to most subnational climate investments, which likely was a recognition of the localised nature of efforts to reduce emissions. In addition, climate plans and programmes in all four case study governments recognised the need to involve a wide range of stakeholders in order to achieve the economic, social and environmental objectives inherent to many subnational climate investments. Technical assistance and capacity building were also common means of support provided by national or state governments to regional or local authorities. Regarding challenges, there seems to be limited formal co-operation across subnational governments on climate investments (horizontal co-ordination). National/state governments provided most of the climate funding to companies and individuals directly, rather than transferring them through subnational governments. For this reason, involvement of the private sector in subnational climate investments seems limited. Moving forward, it is important to develop ways to better channel the funding from international organisations and national governments to support subnational governments in addressing climate priorities.

Building on these findings, it would be useful to analyse more cases worldwide to provide a better understanding of the policy implications for an integrated approach. Better tracking subnational climate-related spending is a top priority in both developed and developing countries. At the same time, sharing

knowledge and facilitating dialogue among OECD member and non-member countries would be crucial to more effectively scale up an integrated approach to implement the Paris Agreement.

References

Aguilar-Jaber, A., Anderson, B., Nachtigall, D., and F. Ngom (forthcoming), "Long-term low emissions development strategies: cross-country experience", *OECD Environment Working Papers*, OECD Publishing, Paris.

Allain-Dupré, D., C. Hulbert and M. Vincent (2017), "Subnational Infrastructure Investment in OECD Countries: Trends and Key Governance Levers", *OECD Regional Development Working Papers*, No. 2017/05, OECD Publishing, Paris, https://doi.org/10.1787/e9077df7-en.

Blok, K., Höhne, N., der Leun, K. & N. Harrison (2012), "Bridging the greenhouse gas emissions gap", Nature Climate Change (2), available at https://doi.org/10.1038/nclimate1602.

BMUB (2016) *Climate Action Plan 2050 – Germany's long-term emission development strategy,* Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), Berlin, accessible at https://www.bmu.de/en/topics/climate-energy/climate/national-climate-policy/greenhouse-gas-neutral-germany-2050/.

BMUB (2015) *Climate action needs your initiative: The National Climate Initiative*, September 2015, BMUB, Berlin, available at http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/nki_faltblatt_2015_en_bf.pdf.

BMUB (2014a), "National climate policy", BMUB, Berlin, webpage available at www.bmub.bund.de/en/topics/climate-energy/climate/national-climate-policy.

BMUB (2014b) *The German Government's Climate Action Programme 2020*, Cabinet Decision 3 December 2014, BMUB, Berlin, available at www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/aktionsprogramm_klimaschutz_2020_broschuere_en_bf.pdf.

Broekhoff, D., Erickson, P. & C. Lee (2015), "What cities do best: Piecing together an efficient global climate governance", Stockholm Environment Institute Working Paper, available at https://www.sei.org/publications/what-cities-do-best-piecing-together-an-efficient-global-climate-governance/.

Bulkeley, H. (2010), Cities and the Governing of Climate Change. *The Annual Review of Environment and Resources,* 35, pp. 229 -253.

Bulkeley, H. & V. Castán Broto (2013), "Government by experiment? Global cities and the governing of climate change", Transactions of the Institute of British Geographers, 38(3), available at http://dx.doi.org/10.1111/j.1475-5661.2012.00535.x.

California ARB (2019), "AB 32 Scoping Plan", California Environmental Protection Agency Air Resources Board (California ARB), Sacramento, California, available at www.arb.ca.gov/cc/scopingplan/scopingplan.htm.

California ARB (2016a), "Local Government Actions for Climate Change", California Environmental Protection Agency Air Resources Board, Sacramento, California, available at www.arb.ca.gov/cc/localgovernment/localgovernment.htm.

California ARB (2016b), "Sustainable Communities", California Environmental Protection Agency Air

Resources Board, Sacramento, California, available at www.arb.ca.gov/cc/sb375/sb375.htm.

California ARB (2014), "Assembly Bill 32 Overview", California Environmental Protection Agency Air Resources Board, Sacramento, California, available at www.arb.ca.gov/cc/ab32/ab32.htm.

California Climate Investments Map (no date), "Summary of Investments", State of California, Sacramento, California, available at www.climateinvestmentmap.ca.gov.

California Climate Investments (2016), *Annual Report to the Legislature on California Climate Investments Using Cap-and-Trade Auction Proceeds*, March 2016, California Air Resources Board, Sacramento, California, available at http://arb.ca.gov/cc/capandtrade/auctionproceeds/cci_annual_report_2016_final.pdf.

Canadian Intergovernmental Conference Secretariat (2016), "Vancouver Declaration on clean growth and climate change", 3 March 2016, Canadian Intergovernmental Conference Secretariat, Ottawa, available at www.scics.gc.ca/english/conferences.asp?a=viewdocument&id=2401.

Canadian Ministry of Environment and Climate Change (2016), "Canada's Way Forward on Climate Change", webpage updated 19 April 2016, Ministry of Environment and Climate Change, Ottawa, available at: www.climatechange.gc.ca/default.asp?lang=En&n=72F16A84-1.

Canadian Press (2016), "Environment Minister Catherine McKenna announces 20 municipal green grants, loans", *CBC News,* 10 February, 2016, CBC/Radio-Canada, Toronto, available at www.cbc.ca/news/politics/mckenna-green-fund-cities-grants-loans-1.3442159.

carbon*n* Climate Registry (2019), available at https://carbonn.org/ (last accessed 30 September 2019).

CDP (2019a), States and Regions Climate Action Tracker, available at https://www.cdp.net/fr/research/global-reports/states-and-regions-climate-action-tracker.

CDP (2019b), CDP Open Data Platform, available at https://data.cdp.net/ (last accessed 30 September 2019).

Chan, S., Ellinger, P. & O. Widerberg (2018), "Exploring national and regional orchestration of non-state action for a < 1.5 °C world", International Environmental Agreements: Politics, Law and Economics, Volume 18, Issue 1, https://doi.org/10.1007/s10784-018-9384-2.

Climate Chance (2018), *Global Observatory on Non-State Climate Action: Book 2, The Mobilisation of the Local and Subnational Governments*, Climate Chance Association, Paris, France, available at https://www.climate-chance.org/en/observatory-of-action/2018report/.

CoolCalifornia.org (n.d.), "Local Government", webpage available at http://www.coolcalifornia.org/local-government.

CoR (2018), *CDR-2018-923: Climate governance after 2020: a European and global perspective – a contribution to the UNFCCC COP24*, available at https://cor.europa.eu/EN/our-work/Pages/OpinionTimeline.aspx?opId=CDR-923-2018.

Council of the Federation (2015), *Canadian Energy Strategy*, July 2015, Council of the Federation Secretariat, Ottawa, available at: www.canadaspremiers.ca/phocadownload/publications/canadian_energy_strategy_eng_fnl.pdf.

CUT (2019), *Climate Emergency, Urban Opportunity: How National Government Can Secure Economic Prosperity and Avert Climate Catastrophe by Transforming Cities*, Coalition for Urban Transitions (CUT), available at https://www.globalcovenantofmayors.org/wp-content/uploads/2019/09/Climate-Emergency-Urban-Opportunity-report.pdf.

C40 (2019), "How road pricing is transforming London – and what your city can learn", Cities Climate Change Leadership Group (C40), C40 Knowledge Hub, https://www.c40knowledgehub.org/s/article/How-road-pricing-is-transforming-London-and-what-your-city-can-learn?language=en_US.

C40 (2017), *Focused acceleration: A strategic approach to climate action in cities to 2030*, available at https://c40-production-images.s3.amazonaws.com/researches/images/66_MCBE_C40_Focused_Acceleration_report.original.pdf?1510424835.

C40/Arup (2011), *Climate Action in Megacities: C40 Cities Baseline and Opportunities*, available at https://www.c40.org/researches/arup-c40-baseline-report.

C40/NCI (2017), *Opportunity 2030: Benefit of Climate Action in Cities: Quantifying the benefits of city-level measures in buildings, transport and energy supply*, New Climate Institute (NCI), available at https://c40-production-images.s3.amazonaws.com/other_uploads/images/1668_C40_Opportunities_2030_report.original.pdf?1520440895.

C40/Arup (2016), *Deadline 2020: How Cities Will Get the Job Done*, available at https://c40-production-images.s3.amazonaws.com/researches/images/59_C40_Deadline_2020_Report.original.pdf?1480609788.

Dobbs, R., Smit, S., Remes, J., Manyika, J., Roxburgh, C., & A. Restrep. (2011), *Urban world: Mapping the economic power of cities,* McKinsey Global Institute, available at https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Urbanization/Urban%20world/MGI_urban_world_mapping_economic_power_of_cities_full_report.ashx.

Ecolise (2018), "Local, Community-Led: a New Future Unfolding", European Network for Community-Led Initiatives on Climate Change and Sustainability, available at: https://www.ecolise.eu/wp-content/uploads/2018/09/ECOLISE_BOOKLET_2018_LR.pdf.

Ferris, E. (2013), Implementing Climate Mitigation Policy at a Subnational Level: Lessons from British Columbia. Master's Thesis, The University of British Columbia.

Florida, R. (2018), *What to do about the rise of mega-regions*, http://www.citylab.com/equity/2018/06/urbanism-shouldnt-be-a-story-of-winners-andlosers/562583.

Funding Wizard (n.d.), "Welcome to the Funding Wizard", Sacramento, California, available at https://fundwiz.ice.ucdavis.edu.

GCOM (2018), *Implementing Climate Ambition: Global Covenant of Mayors 2018 Global Aggregation Report*, Global Covenant of Mayors for Climate & Energy (GCOM), available at https://www.globalcovenantofmayors.org/wp-content/uploads/2018/10/2018_GCOM_report_web.pdf.

Government of Canada (2015), "Canada's INDC Submission to the UNFCCC", Government of Canada, Ottawa, available at www4.unfccc.int/submissions/INDC/Published%20Documents/Canada/1/INDC%20-%20Canada%20-%20English.

Government of Canada (2016a), *Pan-Canadian Framework on Clean Growth and Climate Change : Canada's plan to address climate change and grow the economy,* Government of Canada, Ottawa, http://publications.gc.ca/collections/collection_2017/eccc/En4-294-2016-eng.pdf.

Government of Canada (2016b), *Canada's Second Biennial Report on Climate Change*, Government of Canada, Ottawa, available at www.ec.gc.ca/GES-GHG/default.asp?lang=En&n=02D095CB-1.

Government of Canada (2016c), Canada's Mid-Century Long-Term Low-Greenhouse Gas Development Strategy, Government of Canada, Ottawa, available at http://publications.gc.ca/collections/collection_2017/eccc/En4-291-2016-eng.pdf.

Government of Canada (2017), *Canada's 2017 Nationally Determined Contribution Submission to the United Nations Framework Convention on Climate Change,* Government of Canada, Ottawa, http://www4.unfccc.int/ndcregistry/PublishedDocuments/Canada%20First/Canada%20First%20NDC-Revised%20submission%202017-05-11.pdf.

Graichen, J., Healy, S., Siemons, A., Höhne, N., Kuramochi, T., Gonzales-Zuniga, S., Sterl, S., Kersting, J. & J. Wachsmuth (2017), "International Climate Initiatives – A Way Forward to Close the Emissions Gap? Initiatives' Potential and Role Under the Paris Agreement", Environmental Research of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, available at https://www.umweltbundesamt.de/en/publikationen/international-climate-initiatives-a-way-forward-to-0.

G20 (2019), *G20 Osaka Leaders' Declaration*, https://www.g20.org/pdf/documents/FINAL_G20_Osaka_Leaders_Declaration.pdf.

Harrison, K. and L. McIntosh Sundstrom (2010), "The Struggle of Ideas and Self-Interest in Canadian Climate Policy," in Global Commons, Domestic Decisions: The Comparative Politics of Climate Change, Kathryn Harrison and Lisa McIntosh Sundstrom, eds., Cambridge, MA: MIT Press, 2010.

Hsu, A., Höhne, N., Kuramochi, T., Roelfsema, M., Weinfurter, A., Xie, Y., Lütkehermöller, K., Chan, S., Corfee-Morlot, J., Drost, P., Faria, P., Gardiner, A., Gordon, D., Hale, T., Hultman, N., Moorhead, J., Reuvers, S., Setzer, J., Singh, N., Weber, C. & O. Widerberg (2019a), "A research roadmap for quantifying non-state and subnational climate mitigation action", Nature Climate Change (9), available at https://doi.org/10.1038/s41558-018-0338-z.

Hsu, A., Brandt, J., Widerberg, O., Chan, S., & A. Weinfurter (2019b), "Exploring links between national climate strategies and non-state and subnational climate action in nationally determined contributions (NDCs)", Climate Policy, DOI: 10.1080/14693062.2019.1624252.

ICLEI (2017), *Boosting subnational climate action*, retrieved from: http://carbonn.org/20171101_cCR report_final-web.pdf.

ICLEI, GIZ and UN-Habitat (2018), "Talanoa and Beyond: Raising Ambition with Cities and Regions", retrieved from: http://www.cities-and-regions.org/cop23/wp-content/uploads/2018/02/180430_giz-iclei-un-h_talanoa_final_web.pdf.

ICLEI USA (2017), *Localizing the Paris Agreement: A Guide for Local Government Action in Support of the U.S. Nationally Determined Contribution Localizing the Paris Agreement Localizing the Paris Agreement*, ICLEI USA, Denver, http://icleiusa.org/wp-content/uploads/2017/09/Localizing-the-Paris-Agreement-ICLEI-USA-2017.pdf.

IEA (2018), *World Energy Outlook 2018*, IEA, Paris, https://doi.org/10.1787/weo-2018-en.

IEA (2016), *Energy Technology Perspectives 2016*, OECD Publishing, Paris, http://dx.doi.org/10.1787/energy_tech-2016-en.

IPBES (2019, draft), *Global Assessment Report on Biodiversity and Ecosystem Services*, Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), available at https://www.ipbes.net/global-assessment-report-biodiversity-ecosystem-services.

IPCC (2019), "2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Glossary", advance version available at https://www.ipcc.ch/site/assets/uploads/2019/06/19R_V0_02_Glossary_advance.pdf.

IPCC (2018), *Global Warming of 1.5°C: An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways*, Intergovernmental Panel on Climate Change, Geneva, https://www.ipcc.ch/sr15/download/.

IPCC (2014), *Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Intergovernmental Panel on Climate Change, Geneva, http://dx.doi.org/10.1017/CBO9781107415324.

Jorgensen, K., Jogesh, A. and Mishra, A. (2015) Multi-level climate governance and the role of the subnational level. *Journal of Integrative Environmental Sciences*, 12(4), pp. 235 – 245.

Kamal-Chaoui, L. and A. Robert (eds.) (2009), "Competitive Cities and Climate Change", OECD Regional Development Working Papers N° 2, 2009, available at https://www.oecd.org/cfe/regional-policy/44232251.pdf.

Kousky, C., & Schneider, S. H. (2003), Global climate policy: will cities lead the way? *Climate Policy*, *3*(4), pp. 359–372.

Lutsey, N., & Sperling, D. (2008), America's bottom-up climate change mitigation policy. *Energy Policy*, *36*(2), pp. 673–685.

Mehling, M., Metcalf, G., & R. Stavins (2017), "Linking Heterogeneous Climate Policies (Consistent with the Paris Agreement)", Harvard Kennedy School, Cambridge, Massachusetts, available at http://www.mrcbg.org.

MEEM (French Ministry of the Environment, Energy and the Sea) (2014), "Regional Climate, Air, Energy Schemes" ("*Schémas régionaux climat, air, énergie (SRCAE)*"), webpage updated 21 July 2014, MEEM, Paris, available at www.developpement-durable.gouv.fr/Schemas-regionaux-climat-air,32879.html.

MEEM (2015a), "France National Low-Carbon Strategy" brochure, December 2015, MEEM, Paris, available at www.developpement-durable.gouv.fr/IMG/pdf/15147-2_strategie-bas-carbone_4p_GB.pdf.

MEEM (2015b), "Priority actions for territories" ("*Les actions prioritaires des territoires*"), webpage updated 4 August 2015, MEEM, Paris, available at www.developpement-durable.gouv.fr/Les-actions-prioritaires-des,42335.html.

MEEM (2015c), "Call for projects for the development of 1 500 methanisation projects in 3 years" ("*Appel à projets pour le développement de 1 500 projets de méthanisation en 3 ans*"), webpage updated 20 February 2015, MEEM, Paris, available at www.developpement-durable.gouv.fr/Appel-a-projets-pour-le.html.

MEEM (2015d), "Model state" ("*État exemplaire*"), MEEM, Paris, available at www.developpement-durable.gouv.fr/Etat-exemplaire,34309.html.

MEEM (2016a) "Ségolène Royal brought together on 12 May at the Ministry 80 new positive energy territories for green growth" (*Ségolène Royal a réuni le 12 mai au ministère 80 nouveaux territoires à énergie positive pour la croissance verte"*), webpage updated 18 May 2016, MEEM, Paris, available at www.developpement-durable.gouv.fr/Segolene-Royal-reunit-cet-apres,47624.html.

MEEM (2016b) "Call for Projects 'Breathable cities in 5 years'", ("*Appel à projets « Villes respirables en 5 ans »*"), webpage updated 26 January 2016, MEEM, Paris, available at www.developpement-durable.gouv.fr/Appel-a-projets-Villes-respirables,43568.

MOEF (2015), *State Action Plan on Climate Change,* Ministry of Environment, Forest and Climate Change, Government of India, www.moef.nic.in/ccd-sapcc.

Morrow, A. (2015), "What you need to know about the Canadian Energy Strategy", *The Globe and Mail*, last updated 16 July 2015, The Globe and Mail Inc., Toronto, available at: www.theglobeandmail.com/news/national/what-you-need-to-know-about-the-canadian-energy-strategy/article25522964/.

MTES (2018a), *Évaluation Environnementale Stratégique de la Stratégie Nationale Bas-Carbone : Rapport d'évaluaton environnementale stratégique*, Ministère de la transition écologique et solidaire (MTES), Paris, France, available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/EES_SNBC_complet.pdf.

MTES (2018b), *Projet de Stratégie Nationale Bas-Carbone : La transition écologique et solidaire vers la neutralité carbone*, Ministère de la transition écologique et solidaire (MTES), Paris, France, available at https://www.ecologique-

solidaire.gouv.fr/sites/default/files/Projet%20strategie%20nationale%20bas%20carbone.pdf.

MTES (2018c), *Le Plan National d'Adaptation au Changement Climatique (PNACC 2)*, Ministère de la transition écologique et solidaire (MTES), Paris, France, available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/2018.12.20_PNACC2.pdf.

MTES (2018d), « Adaptation de la France au changement climatique : 2e Plan national d'adaptation au changement climatique », Ministère de la transition écologique et solidaire (MTES), Paris, France, available at https://www.ecologique-solidaire.gouv.fr/adaptation-france-au-changement-climatique.

Munich RE (2018), *NatCatSERVICE: Loss events worldwide 1980 – 2017*, available at: https://natcatservice.munichre.com/.

NDC Partnership (n.d.), *NDC Partnership*, available at: https://ndcpartnership.org/.

OECD (2019a), *Accelerating Climate Action: Refocusing Policies through a Well-being Lens*, OECD Publishing, Paris, https://doi.org/10.1787/2f4c8c9a-en.

OECD (2019b), *Responding to Rising Seas: OECD Country Approaches to Tackling Coastal Risks*, OECD Publishing, Paris, https://doi.org/10.1787/9789264312487-en.

OECD (2019c), *OECD Regional Outlook 2019: Leveraging Megatrends for Cities and Rural Areas*, OECD, Publishing, Paris, https://doi.org/10.1787/9789264312838-en.

OECD (2019d), "Financing climate objectives in cities and regions to deliver sustainable and inclusive growth", *OECD Environment Policy Papers*, No. 17, OECD Publishing, Paris, https://doi.org/10.1787/ee3ce00b-en.

OECD (2018a), *Inclusive Growth in Seoul, Korea,* OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264290198-en.

OECD (2018b), *Subnational governments in OECD countries: Key data*, available at www.oecd.org/regional/regionalpolicy/Subnational-governments-in-OECD-Countries-Key-Data-2018.pdf.

OECD (2017a), *Investing in Climate, Investing in Growth*, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264273528-en.

OECD (2017b), Environmental Fiscal Reform: Progress, Prospects and Pitfalls, OECD Report for the G7 Environment Ministers (June 2017), https://www.oecd.org/tax/tax-policy/environmental-fiscal-reform-G7-environment-ministerial-meeting-june-2017.pdf.

OECD (2016), *Urban Green Growth in Dynamic Asia*, OECD Green Growth Studies, OECD Publishing, Paris, https://doi.org/10.1787/9789264266360-en.

OECD (2015), *Towards Green Growth?: Tracking Progress*, OECD Green Growth Studies, OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264234437-en.

OECD (2015b), *Water and Cities: Ensuring Sustainable Futures*, OECD Studies on Water, OECD Publishing, Paris, https://doi.org/10.1787/9789264230149-en.

OECD (2014), *Recommendation of the Council on Effective Public Investment Across Levels of Government*, adopted 12 March 2014, OECD, Paris, available at http://www.oecd.org/gov/regional-policy/Principles-Public-Investment.pdf.

OECD (2013), Green Growth in Cities, OECD Green Growth Studies, OECD Publishing. http://dx.doi.org/10.1787/9789264195325-en.

OECD (2010), *Cities and Climate Change,* OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264091375-en.

OECD (n.d.), "A territorial approach to the Paris Agreement: Accelerating the role of local and regional governments in climate action", OECD, Paris, unpublished.

OECD/Bloomberg (2014), *Cities and Climate Change – National governments enabling local action,* http://www.oecd.org/environment/cc/Cities-and-climate-change-2014-Policy-Perspectives-Final-web.pdf.

OECD/IEA/NEA/ITF (2015), *Aligning Policies for a Low-carbon Economy,* OECD Publishing, Paris, http://dx.doi.org/10.1787/9789264233294-en.

OECD/UCLG (2016b), *Subnational Governments around the world: Structure and finance*, OECD & United Cities and Local Government (UCLG), World Observatory on Subnational Government Finance and Investment, available at http://www.oecd.org/regional/regional-policy/Subnational-Governments-Around-the-World-%20Part-I.pdf.

OECD/World Bank/UNEP (2018), *Financing Climate Futures: Rethinking Infrastructure*, OECD Publishing, Paris. https://doi.org/10.1787/9789264308114-en.

ONERC (2018), « PNACC 2 : Renforcer l'adaptation à l'échelle locale », Lettre aux élus, n 30, Observatoire National sur les Effets du Réchauffement Climatique (ONERC), Paris, France, available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/ONERC_Lettre_30.pdf.

ONERC (2017), *Vers un 2e plan d'adaptation au changement climatique pour la France : Enjeux et recommandations : Rapport au Premier ministre et au Parlement*, Observatoire National sur les Effets du Réchauffement Climatique (ONERC), Paris, France, available at https://www.ecologique-solidaire.gouv.fr/sites/default/files/ONERC_Rapport_2017_vers_PNACC-2_Web.pdf.

Pauw, W, Klein, R., Mbeva, K., Dzebo, A., Cassanmagnago, D. & A. Rudloff (2018), "Beyond headline mitigation numbers: we need more transparent and comparable NDCs to achieve the Paris Agreement on climate change", Climatic Change Vol. 147 (1-2), https://doi.org/10.1007/s10584-017-2122-x.

Regions4SD (2016), *RegionsAdapt 2016 Report: An assessment of risks and actions,* Regions 4 Sustainable Development (Regions4SD), available at https://www.regions4.org/publications/regionsadapt-2016-report-an-assessment-of-risks-and-actions.

Rocha, M. and C. Falduto (2019), "Key questions guiding the process of setting up long-term low-emissions development strategies", *OECD/IEA Climate Change Expert Group Papers*, OECD Publishing, Paris.

SDSN (2016), *Getting Started with the SDGs in Cities: A Guide for Stakeholders*, New York, United States of America: United Nations Sustainable Development Network (SDSN), http://unsdsn.org/wp-content/uploads/2016/07/9.1.8.-Cities-SDG-Guide.pdf.

Smith, R. & K. McNamara (2015), "Future migrations from Tuvalu and Kiribati: exploring government, civil society and donor perceptions", *Climate and Development*, Vol. 7/1, pp. 47-59, http://dx.doi.org/10.1080/17565529.2014.900603.

State of California (2014), *First Update to the Climate Change Scoping Plan: Building on the Framework*, May 2014, State of California, Sacramento, California, available at www.arb.ca.gov/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf.

State of California (2016), *Cap-and-Trade Auction Proceeds Second Investment Plan: Fiscal Years 2016-17 through 2018-19*, January 2016, State of California, Sacramento, California.

UN (2018), *World Urbanization Prospects: The 2018 Revision*, New York, United States of America: United Nations (UN), Department of Economic and Social Affairs, Population Division, https://population.un.org/wup/Download/.

UN-Habitat (2017), *Sustainable Urbanization in the Paris Agreement: Comparative Review of Nationally Determined Contributions for Urban Content*, United Nations Human Settlements Programme (UN-Habitat), available at https://urban-leds.org/wp-content/uploads/2019/resources/guidance_and_tools/Integrated_climate_action/Sustainable%20Urba

nization%20in%20the%20Paris%20Agreement%20-%20Comparative%20Review%20of%20NDC%20-%20July%202018.pdf.

UN-Habitat (2016), *Urbanization and Development: Emerging Future World cities Report*, https://unhabitat.org/wp-content/uploads/2014/03/WCR-%20Full-Report-2016.pdf.

UN-Habitat (2011), *Cities and Climate Change: Global Report on Human Settlements*, available at https://new.unhabitat.org/sites/default/files/download-manager-files/Cities%20and%20Climate%20Change%20Global%20Report%20on%20Human%20Settlements%202011.pdf.

Under2Coalition (2019), *Under2Coalition Highlights Report 2019*, available at https://www.under2coalition.org/sites/default/files/under2_coalition_highlights_report_2019_-_digital.pdf.

Under 2 MOU (n.d.), *Subnational Global Climate Leadership Memorandum of Understanding*, Sacramento, California, homepage available at http://under2mou.org.

UNDESA (2016), *The World's Cities in 2016*, http://dx.doi.org/www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2016_data_booklet.pdf.

UNEP (2019), *The Emissions Gap Report 2019*, United Nations Environment Programme (UNEP), Nairobi, Kenya.

UNEP (2018), *The Emissions Gap Report 2018*, United Nations Environment Programme, Nairobi, Kenya.

UNEP (2015), "Climate commitments of subnational actors and business: A quantitative assessment of their emission reduction impact," Nairobi, United Nations Environment Programme.

UNFCCC (2019), "Communication of long-term strategies", available at https://unfccc.int/process/the-paris-agreement/long-term-strategies (last accessed, 27 June 2019).

UNFCCC (2015), *The Paris Agreement*, United Nations Framework Convention on Climate Change (UNFCCC), 21st Conference of the Parties, https://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf.

WMO (2019), "Press release: Global climate 2015-2019: climate change accelerates", World Meteorological Organisation (WMO), accessible at https://public.wmo.int/en/media/press-release/global-climate-2015-2019-climate-change-accelerates.

WMO/GCP/UNEP/IPCC/GFCS (2019), *High-level synthesis report of latest climate science information convened by the Science Advisory Group of the UN Climate Action Summit 2019*, World Meteorological Organization (WMO), Global Carbon Project (GCP), UN Environment Programme (UNEP), International Panel on Climate Change (IPCC), Global Framework of Climate Services (GFCS), available at https://ane4bf-datap1.s3-eu-west-1.amazonaws.com/wmocms/s3fs-public/ckeditor/files/United_in_Science_ReportFINAL_0.pdf?XqiG0yszsU_sx2vOehOWpCOkm9RdC_gN.

Yale, NCI & PBL (2018), *Global climate action of regions, states and businesses: Individual actors, collective initiatives and their impact on global greenhouse gas emissions*, Data Driven Yale (Yale), NewClimate Institute (NCI), PBL Netherlands Environmental Assessment Agency (PBL), http://bit.ly/yale-nci-pbl-global-climate-action.