

# THE CLIMATE PATHWAY PROJECT



# Development and evaluation of Querétaro's decarbonisation pathway

## FINAL REPORT

WITH THE SUPPORT OF



MAIN PARTNER

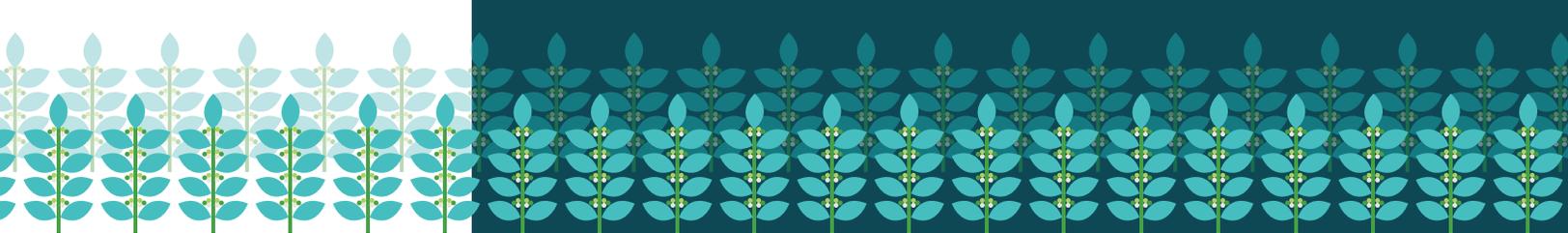


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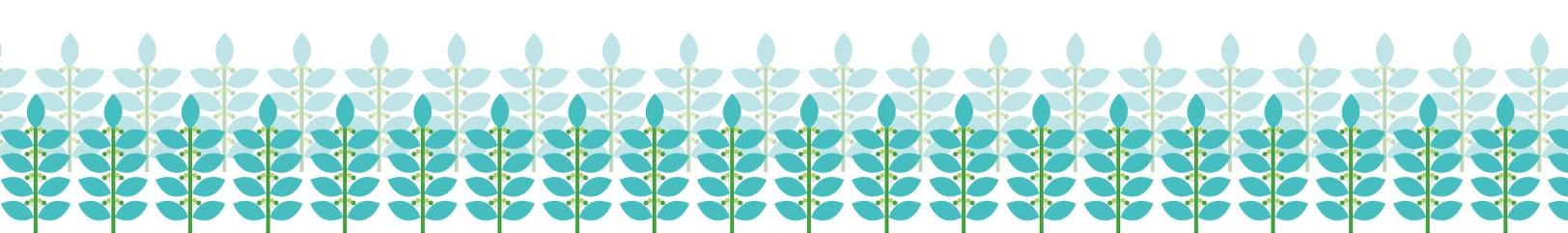
PARTNERS





# Abbreviations

<b>AFOLU</b>	Agriculture, forestry and other land uses
<b>BAU</b>	Business as usual
<b>C</b>	Celsius
<b>CE</b>	Cost effectiveness
<b>CECC</b>	State Center for Ecology and Climate Change
<b>CCS</b>	Center for Climate Strategies
<b>CO<sub>2</sub></b>	Carbon dioxide
<b>FOLU</b>	Forestry and other land uses
<b>GHG</b>	Greenhouse gases
<b>GCF</b>	Governors' Climate and Forests Task Force
<b>Ha</b>	Hectare
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>MCA</b>	Multi-Criteria Assessment
<b>MWh</b>	Megawatt hour
<b>NDC</b>	Nationally Determined Contributions
<b>NICFI</b>	Norway's International Climate and Forest Initiative
<b>GNI</b>	Gross National Income
<b>GDP</b>	Gross Domestic Product
<b>RCI</b>	Residential, commercial, and institutional
<b>SEDESU</b>	Secretariat for Sustainable Development of Querétaro
<b>Tg</b>	Teragrams
<b>t</b>	Metric tonnes
<b>VKT</b>	Vehicle-Kilometres Travelled



# Executive Summary

This report includes a summary of the process of development and evaluation of the priority actions of the decarbonisation pathway of the state of Querétaro, Mexico, as well as the results of the main steps of the process, which include:

- 1. Developing the state's baseline;**
- 2. Selecting the state's targets to reduce net GHG emissions by 2030 and 2050;**
- 3. Selecting priority actions for the pathway and their designs;**
- 4. Assessing the expected impacts of implementing the actions on GHG emissions, based on the direct costs and savings of the actions, and on the macroeconomics of the state.**

A decarbonisation pathway is a transformational process to reduce greenhouse gas (GHG) emissions in the long term (2050) through a series of actions in key economic sectors that will change the business as usual projection of these GHG emissions (i.e. baselines), through the application of new and improved technologies and practices.

This executive summary has been translated into English, please note that the full technical report is only available in Spanish.

## Pathway development and assessment process

This was a collaborative process between the Querétaro state government and a team of international technical experts. The state government's efforts were led by the Undersecretary of the Environment and the State Centre for Ecology and Climate Change (CECC; in Spanish) of the Secretariat for Sustainable Development of Querétaro (SEDESU; in Spanish). The project team consisted of the Climate Group, Winrock International, and the Center for Climate Strategies (CCS). Throughout the process, input and feedback from other key public and private sector stakeholders was solicited and incorporated through face-to-face and remote workshops.

## Baseline

The baseline developed revealed that in the baseline year 2015, Querétaro's total GHG emissions were 9.4 TgCO<sub>2</sub>e, and it was projected that by 2030 these emissions would double to 16.7 TgCO<sub>2</sub>e, and by 2050 they would triple to 33.5 TgCO<sub>2</sub>e. According to this analysis, the most important drivers of emissions are energy supply (which includes in state electricity generation and electricity imports), energy demand for transport and energy demand in the industry sector.

## Decarbonisation target

The selection of a GHG emissions reduction target for the state of Querétaro was based on the level of emissions reduction required globally to limit global warming to less than 2°C above preindustrial levels. An assessment of the state-level emission reduction targets needed to achieve consistency with the goal of limiting global warming to 2°C was carried out. These targets also reflect the state's commitments as a member of the Under2 Coalition. Based on this assessment, the state of Querétaro selected the following state-level GHG reduction targets:

- By 2030, 27% reduction of GHG emissions below the 2015 emissions level (i.e. a reduction of emissions to a level of 6.9 TgCO<sub>2</sub>e by 2030).
- By 2050, 65% reduction of GHG emissions below the 2015 emissions level (i.e. a reduction of emissions to a level of 3.2 TgCO<sub>2</sub>e by 2050).

## Selected priority actions

Twelve priority actions were selected to be included in Querétaro's pathway:



**Energy supply sector:** Centralised solar energy.



**Residential, commercial, and institutional energy demand sector:** Solar action distributed in the commercial and institutional sector



**Industry energy demand sector:** 1) On-site renewable electricity production. 2) Production and use of renewable fuels. 3) On-site renewable heat production. 4) Electrical energy efficiency.



**Transport energy demand sector:** 1) Smart urban planning. 2) Vehicle electrification.



**Agriculture and livestock sector:** 1) Agroforestry systems. 2) Regeneration of grazing land.



**Forestry and other land use sector:** 1) Expansion of the forest ecosystem. 2) Conservation of forest land.

## Expected impacts of implementing the actions

### *Expected impacts of action implementation on GHG emissions*

By implementing the twelve actions, GHG emissions reductions of 4 TgCO<sub>2</sub>e (i.e. a 25% reduction compared to BAU levels) are expected by 2030. By 2050, reductions of 18 TgCO<sub>2</sub>e (i.e. a 54% reduction compared to BAU levels) are expected. Most of the GHG emission reductions will come from priority actions in the industry (62% in 2050) and energy supply (30% in 2050) sectors.

By 2050, GHG emission reductions from the priority actions are estimated to be more than half of those needed to reach the 2050 target (18 TgCO<sub>2</sub>e of the 30 TgCO<sub>2</sub>e needed). The priority actions will greatly slow the growth of GHG emissions over the next two decades; however, they will not produce reductions large enough to meet the state's selected targets (Figure 1). To meet the 2050 target, the state will need to reduce GHG emission levels by around 0.4 TgCO<sub>2</sub>e/year by 2050.

After the expected implementation of the priority actions in 2050, the majority of emissions will remain in the transport and industry sectors.

Through this project, Querétaro has set ambitious and transformative decarbonisation targets and the priority actions represent a significant undertaking by the state to achieve them due to the significant effort (target) levels. To achieve the targets, an additional 5.6 TgCO<sub>2</sub>e emissions reduction will be needed by 2030 and an additional 12 TgCO<sub>2</sub>e emissions reduction by 2050.

## Expected impacts on cost magnitude and direct savings

The implementation of more than half of the priority actions (8 out of 12) is expected to generate net savings over time. These net savings are also expected to be small for most of these actions (6 out of 8) compared to the expenditure levels in the baseline sectors. Significant savings are estimated for the solar power generation action alone in the energy supply sector. Generally, this is because the savings that accrue over time are higher than the costs required to implement an action.

It is important to note that the cost and savings analysis did not take into account the social cost of carbon, i.e. the avoided damage that each metric tonne of GHG caused to society due to the negative impacts of climate change. It also did not include the impacts of the services that newly established forest ecosystems and existing conserved forest ecosystems would provide (in addition to carbon dioxide removals).

## Expected macroeconomic impacts

An assessment based on previous indicators and empirical modelling was carried out to determine the potential direction and magnitude of impacts on employment, income and economic growth driven by the priority actions. The six indicators include shifts in favour of: 1) Technologies and practices with lower net implementation costs than in the BAU scenario; 2) Energy and natural resource expenditures; 3) Local energy supply and other local resources; 4) Local supply chains; 5) Labour intensive activities; and 6) External sources of investment and income.

The vast majority of the priority actions have positive macroeconomic indicators, meaning that they are likely to generate a positive macroeconomic impact for Querétaro's economy if implemented to capitalise on the key drivers of macroeconomic gain. However, it is important to note that the priority actions do not represent major deviations from economic growth patterns or show the potential for a disruptive influence if one considers - as evidenced in the previous section - that the potential direct costs or savings are generally a small percentage of the level of expenditures of the associated sectors.

## Conclusion

Querétaro has set ambitious and transformative decarbonisation targets and the priority actions included in its pathway so far represent a significant effort by the state to achieve them. While these 12 priority actions only partially help the state achieve its 2030 and 2050 GHG reduction targets, they position Querétaro well to advance its decarbonisation process and achieve other important socio-economic goals for the state.

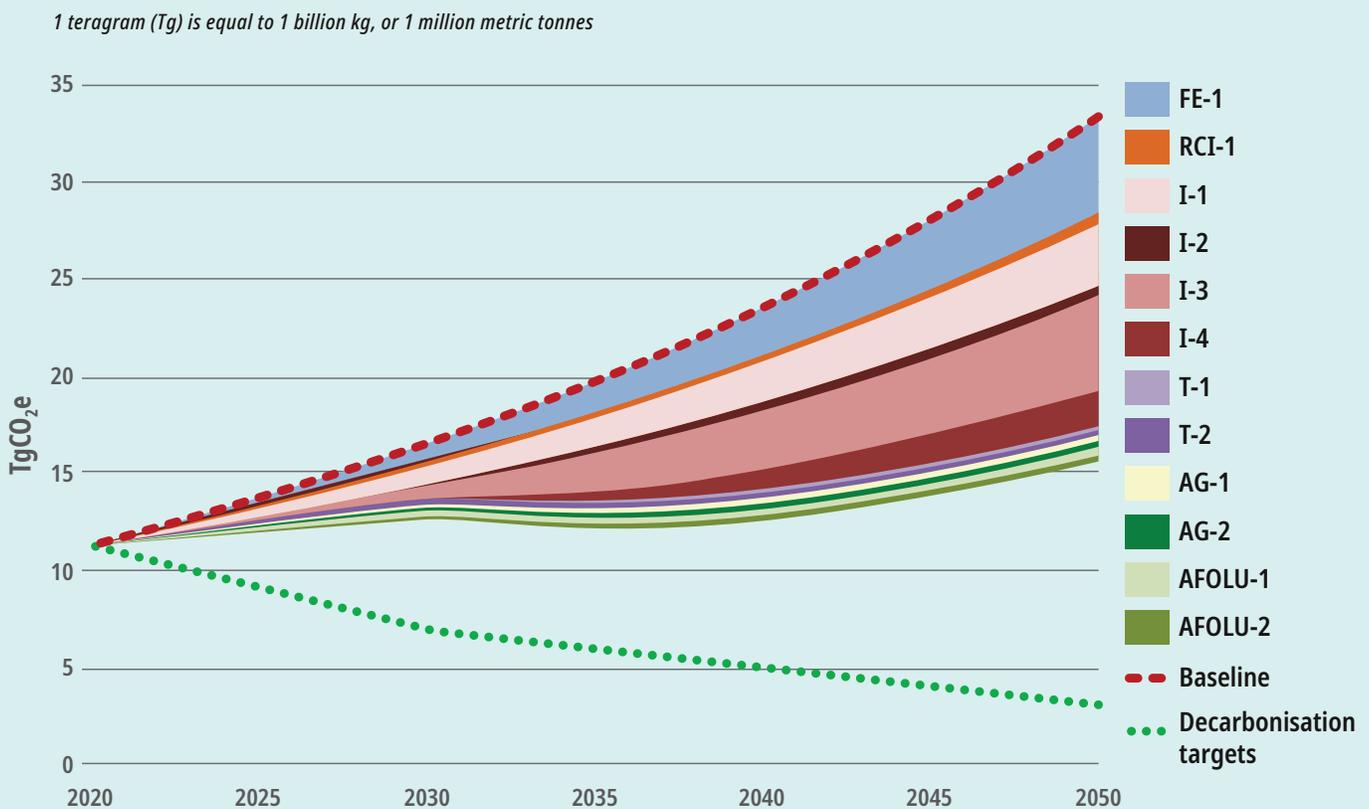
On the one hand, the state will need to identify specific implementation mechanisms for the quantification of costs and benefits, and consequently, identify financing mechanisms for the different actions so that they can maximise their mitigation potential and socio-economic benefits. On the other hand, it will also be necessary to establish a system for monitoring, reporting, and verifying the impacts of implementing these actions.

The state can achieve the targets by increasing the ambition of priority actions and by identifying and developing additional actions in the economic sectors that are the key drivers of emissions (i.e. the transport, industry, agriculture and livestock, and waste management sectors).

Examples of some ways to increase emission reductions in the state would be to include energy efficiency actions in the RCI sector, electrification actions of fuel consuming industrial processes e.g. in light industry and, in the transport sector, focus on further electrification of the fleet and possibly add a biofuels action.

## Additional information

In a folder attached to this report, all intermediate outputs of this project are included. Annexes I-VIII are the summaries of the sectoral baselines; Annex IX is the methodology used to develop the decarbonisation targets; Annex X includes the sectoral decarbonisation visions; Annex XI includes the sectoral catalogues of mitigation actions; Annex XII includes the definitions of the criteria used to prioritise actions in the MCA survey; Annexes XIII to XXIII are the design documents for each priority action included in the pathway; Annexes XXIV to XXXII are the Excel tools to calculate the baselines for the different sectors and the impacts of the actions on these sectors; and Annexes XXXIII to XXXV are the modules presenting the detailed methodologies of the impact assessments of the actions.



**FIGURE 1. GHG REDUCTIONS FROM PRIORITY ACTIONS**

Note: FE: energy supply, I: industry, T: transportation, AFOLU: agriculture, forestry and other land use.