QUERÉTARO

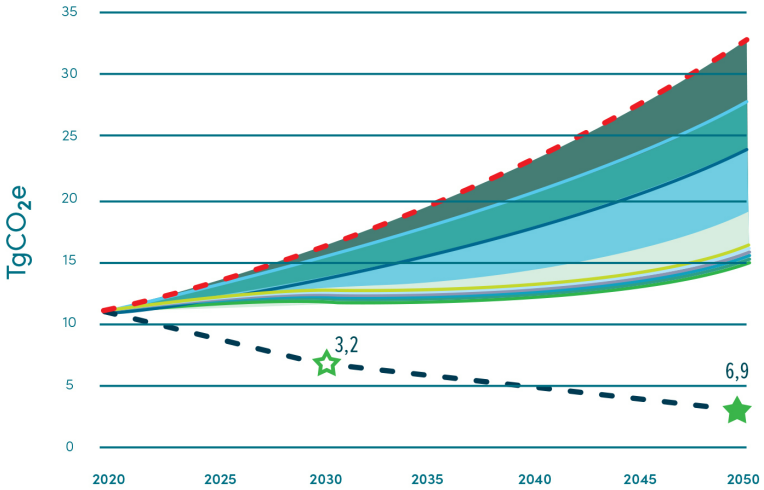
UNDER 2° Secretariat CLIMATE GROUP

Portfolio of actions: Climate Pathway Project

The Government of Querétaro, Mexico has completed a 2.5-year process to develop its decarbonisation pathway. The pathway is based on Querétaro´s reductions targets of 27% by 2030 and 65% by 2050. As part of the process, the government prioritised the 12 mitigation actions shown below.

*Compared to 2015 baseline

Projected GHG emission reductions from prioritised actions in Querétaro



**$TgCO_2e$ = Teragrams of carbon dioxide equivalent, 1 Tg = one million metric tons

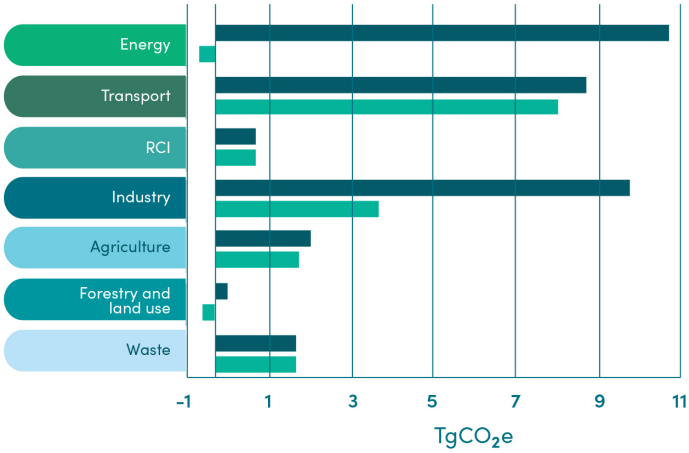
PRIORITY ACTIONS

- Centralised solar energy
- Production and use of biofuels
- Smart urban planning
- Vehicle electrification
- Agroforestry systems
- Pastureland regeneration
- Forest conservation
- Forest ecosystem expansion
- Centralised solar energy for utilities
- On-site renewable electricity production
- On-site renewable heat production
- Electrical energy efficiency
- Baseline / BAU
- Decarbonisation pathway
- Target 2030 = 6,9 $TgCO2e$
- Target 2050 = 3,2 $TgCO2e$

As shown by the graph, the priority actions would amount to a 54% reduction in BAU emissions by 2050.

SECTORAL BREAKDOWN

REMAINING DIRECT EMISSIONS IN 2050 AFTER IMPLEMENTATION OF PRIORITY ACTIONS



Expected impact of priority actions on GHG emissions

The implementation of these actions would add up to approximately

4.2 millon tonnes of avoided emissions by **2030**

And more than

18 millon tonnes of avoided emissions by **2050**

WITH THE SUPPORT OF — MAIN PARTNER — PARTNERS

NICFI Norway's International Climate and Forest Initiative · CLIMATE GROUP · GCF task force · WINROCK INTERNATIONAL · THE CENTER FOR CLIMATE STRATEGIES · libélula

Find the full report here: https://www.theclimategroup.org/climate-pathway-project

E-1. CENTRALISED SOLAR ENERGY

DESCRIPTION: This action is designed to reduce greenhouse gas (GHG) emissions (mainly CO_2) from the electricity supply sector in Querétaro through the construction of new centralised solar power plants connected to the grid.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

- By 2030, reduce the carbon intensity of energy from the grid by 25% from BAU levels through the installation of new solar capacity.
- By 2050, reduce the carbon intensity of grid-based energy by 50% from BAU levels through the installation of new solar capacity.

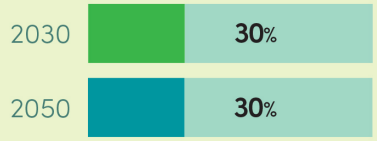
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

68 $TgCO_2e$

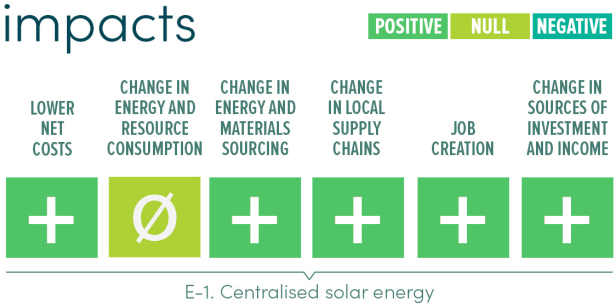
E-1 has a high mitigation potential of **35%** of total emissions in the energy supply sector.

CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)

Macroeconomic impacts



Co-benefits

Costs and savings

Large direct savings for the state due to lower electricity supply costs, as compared to BAU, for both residents and businesses within the state.

RCI-1. DISTRIBUTED SOLAR

DESCRIPTION: This action is designed to reduce greenhouse gas (GHG) emissions (mainly CO_2) from the electricity supply sector in Querétaro through new solar energy projects which allow for on-site production of renewable energy for the state's public and private sectors.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

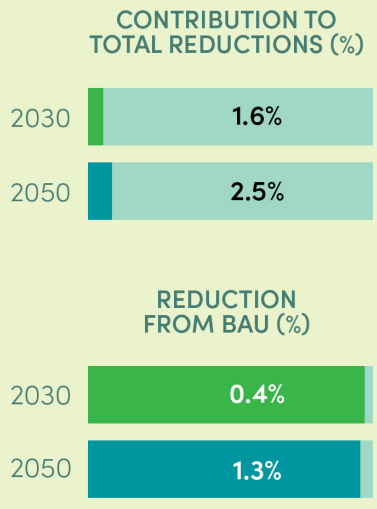
- By 2030, implement on-site photo-voltaic (PV) solar energy projects in private facilities on a scale sufficient to meet 25% of energy consumption in the public/private sector.
- By 2050, implement on-site (PV) solar energy projects in industrial facilities on a scale sufficient to meet 75% of energy consumption in the public/private sector.

Impact on GHG emissions reduction

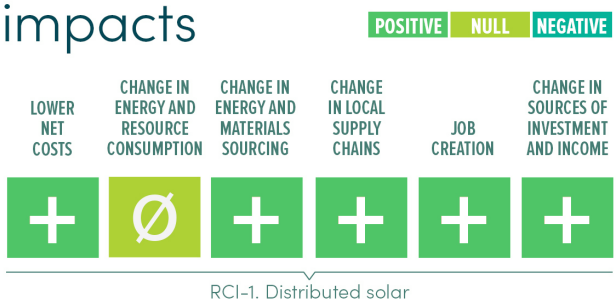
Cumulative GHG emission reductions (2022 - 2050):

5.6 $TgCO_2e$

RCI-1 has a moderate mitigation potential of **16%** of total emissions in the RCI sector (residential, commercial, institutional).



Macroeconomic impacts



Co-benefits

Costs and savings

Small direct savings for the state due to lower electricity supply costs, as compared to BAU, for both public and private sector within the state.

I-1. ON-SITE RENEWABLE ELECTRICITY GENERATION

DESCRIPTION: This action is designed to reduce greenhouse gas (GHG) emissions (mainly CO_2) from the energy supply in Querétaro through new solar energy projects to expand on-site production of renewable energy in the state's industrial sector.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

- By 2030, implement on-site PV solar energy projects in industrial facilities on a scale sufficient to meet 25% of energy consumption in the public/private sector.
- By 2050, implement on-site PV solar energy projects in industrial facilities on a scale sufficient to meet 75% of energy consumption in the public/private sector.

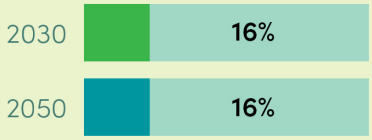
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

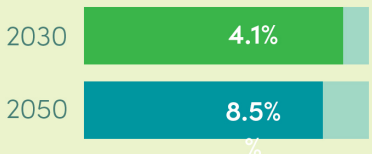
41 $TgCO_2e$

I-1 has a moderate mitigation potential of **16%** reduction of total emissions in the industry sector.

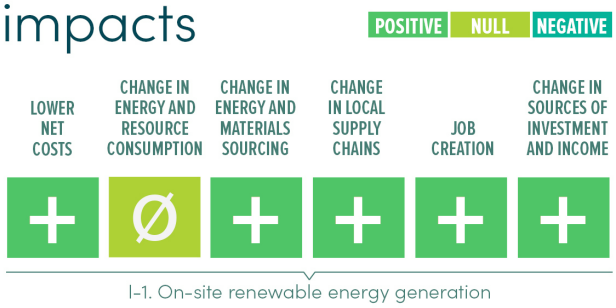
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)

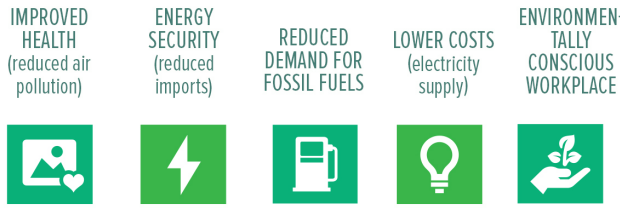


Macroeconomic impacts



I-1. On-site renewable energy generation

Co-benefits



Costs and savings

Moderate direct savings for the state due to lower electricity supply costs, as compared to BAU, for the industrial sector within the state.

I-2. PRODUCTION AND USE OF BIOFUELS

DESCRIPTION: This action is designed to reduce greenhouse gas (GHG) emissions (mainly CO_2) from the consumption of industrial fossil fuels by developing Querétaro's biofuel production industry and replacing fossil fuels with biofuel.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

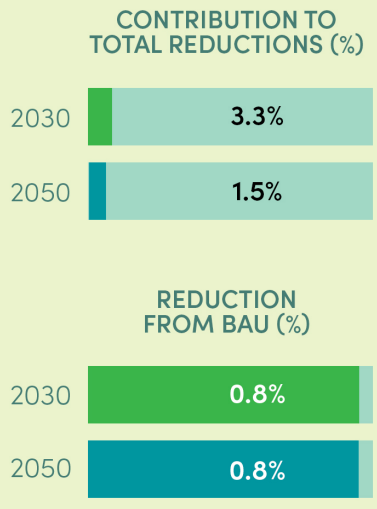
- By 2030, increase biofuel production capacity in the state to offset 5% of fossil fuel consumption.
- By 2050, increase biofuel production capacity in the state to offset 15% of fossil fuel consumption.

Impact on GHG emissions reduction

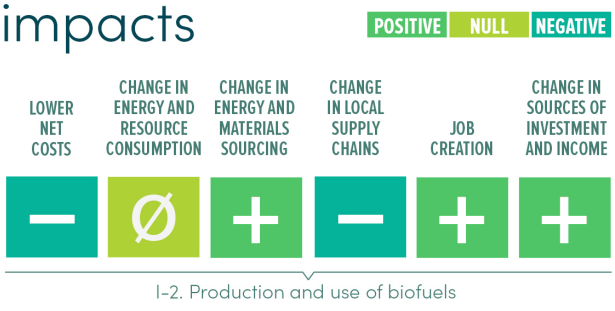
Cumulative GHG emission reductions (2021 - 2050):

5.4 $TgCO_2e$

I-2 has a moderate mitigation potential of **2.1%** reduction of total emissions in the industry sector.



Macroeconomic impacts



I-2. Production and use of biofuels

Co-benefits

Costs and savings

Low direct costs for the state because of the higher costs of biofuels for Querétaro's industrial sector, as compared to the BAU scenario.

I-3. ON-SITE RENEWABLE HEAT PRODUCTION

DESCRIPTION: This action is designed to reduce greenhouse gas (GHG) emissions (mainly CO_2) from industrial fossil fuel consumption by implementing renewable energy technologies to meet the demand for thermal energy.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

· By 2030, implement renewable energy technologies to produce enough thermal energy to supplant 33% of fossil fuel consumption in the following industrial sub-sectors in Querétaro: food and beverage, paper products, textiles, chemicals, rubber and plastic products, machinery, vehicles, and "other" industries.
· By 2050, implement renewable energy technologies to produce enough thermal energy to supplant 80% of fossil fuel consumption in the following industrial sub-sectors in Querétaro: food and beverage, paper products, textiles, chemicals, rubber and plastic products, machinery, vehicles, and "other" industries.

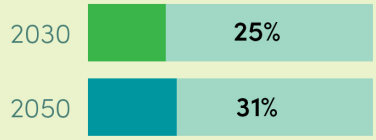
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

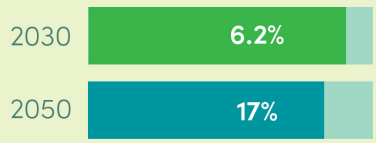
74 $TgCO_2e$

I-3 has a moderate mitigation potential of **29%** reduction of total emissions in the industry sector.

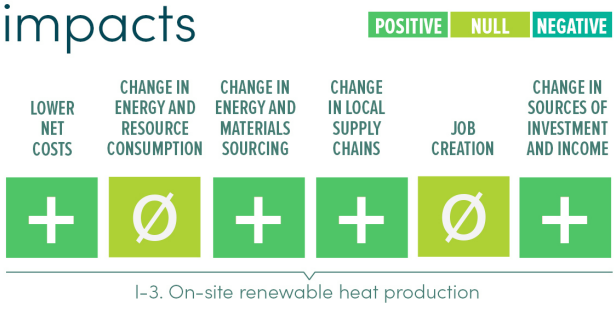
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)

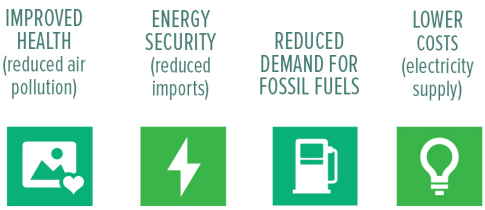


Macroeconomic impacts



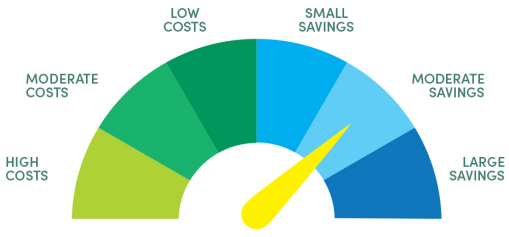
I-3. On-site renewable heat production

Co-benefits



Costs and savings

Moderate direct savings for the state due to lower fuel costs for Querétaro's industrial sector, as compared to the BAU scenario.



I-4. ELECTRICAL ENERGY EFFICIENCY

DESCRIPTION: This action is designed to reduce indirect greenhouse gas (GHG) emissions (mainly CO_2) from energy used to generate electricity in the industrial sector.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

- By 2030, implement energy efficiency measures across the industrial sector to achieve a 20% reduction in electricity consumption.
- By 2050, implement energy efficiency measures across the industrial sector to achieve a 50% reduction in electricity consumption.

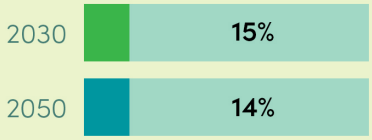
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

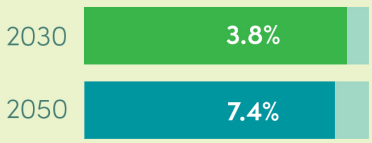
40 $TgCO_2e$

I-4 has a moderate mitigation potential of **16%** reduction of total emissions in the industry sector.

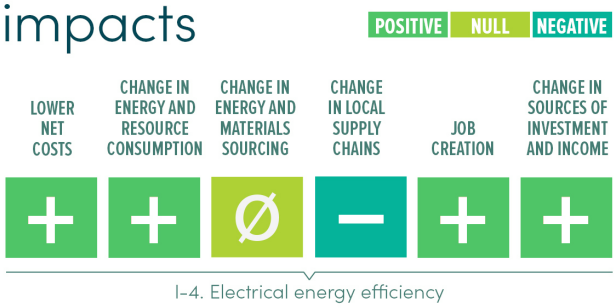
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)

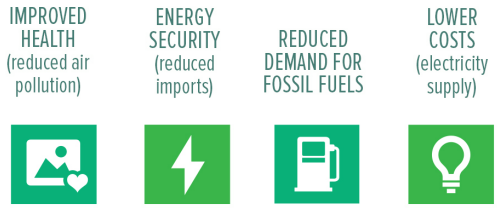


Macroeconomic impacts



I-4. Electrical energy efficiency

Co-benefits



Costs and savings

Small direct savings for the state due to lower energy supply costs for Querétaro's industries, as compared to BAU scenario.

T-1. SMART URBAN PLANNING

DESCRIPTION: Smart urban growth is a development approach, which seeks to provide social and environmental benefits in the use of various living spaces, such as, buildings, housing and means of transport. By working with communities, Smart urban planning aims to provide solutions which positively impact communities and the environment. This may be by seeking an overall reduction in vehicle activity, which can allocate further space for recreational activities within neighbourhoods but also resulting in reduced GHG emissions in these areas.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

- By 2035, support smart urban planning that covers 60% of the population of the state of Querétaro. This includes the municipalities of Corregidora, El Marqués, Huimilpan and Querétaro.
- By 2050, support smart urban planning that covers 75% of the population of the state of Querétaro. This includes the incorporation of the San Juan del Río Metropolitan area.

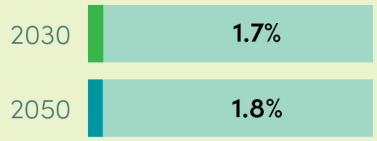
Impact on GHG emissions reduction

Cumulative GHG emissions reductions (2022 - 2050):

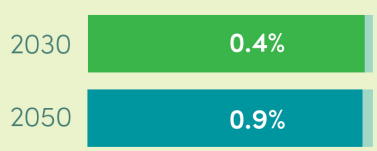
4.3 $TgCO_2e$

T-1 has a low mitigation potential of **2.7%** of total emissions in the transport sector.

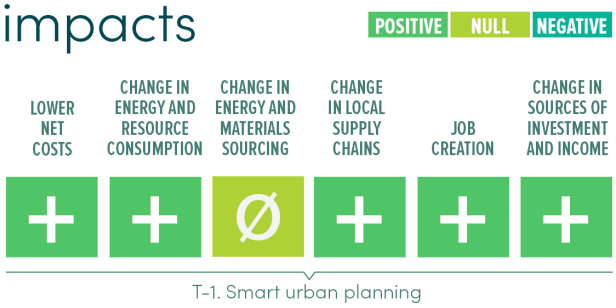
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)



Macroeconomic impacts



Co-benefits

Costs and savings

Small direct savings due to reduced transportation demand by state residents and businesses, as compared to the BAU scenario (e.g. car trips are shorter or fully avoided).

T-2. VEHICLE ELECTRIFICATION

DESCRIPTION: This action is designed to reduce greenhouse gas (GHG) emissions (mainly CO_2) from the transport sector in Querétaro by electrifying vehicles. Vehicle electrification reduces exhaust pipe emissions by reducing the proportion of vehicles that uses traditional internal combustion engines that burn fossil fuels (gasoline and diesel). Electric trains require only one third of the power used by internal combustion engine powered trains. GHG emissions are further reduced when renewable energy is used to power electric vehicles.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

- By 2035, all mechanisms necessary to electrify vehicles in all municipalities will be in place. Electric and hybrid vehicles will represent 50% of new vehicle sales. The state will focus first on light-duty vehicles and then will include heavy-duty vehicles after 5 years.
- By 2050, electric and hybrid vehicles will represent 100% of new vehicle sales.

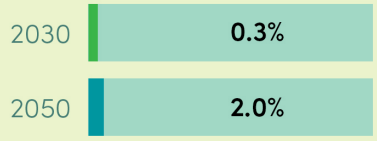
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050) :

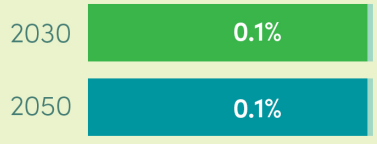
2.5 $TgCO_2e$

T-2 has a low mitigation potential of **1.6%** of total emissions in the transport sector.

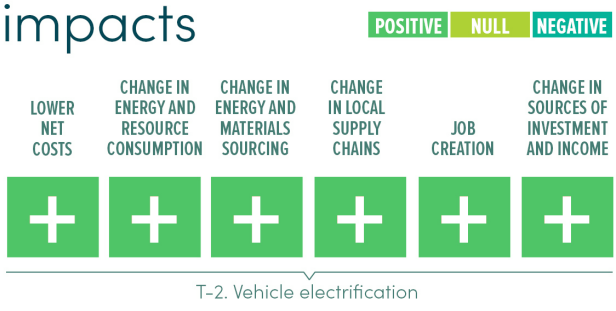
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)



Macroeconomic impacts



Co-benefits

Costs and savings

Small direct savings due to lower costs for electric vehicles than for internal combustion engine vehicles for Querétaro's residents and businesses, as compared to the BAU scenario.

AG-1. AGROFORESTRY SYSTEMS

DESCRIPTION: This action aims to reduce carbon dioxide (CO_2) in the atmosphere by establishing agroforestry systems for annual or perennial crop production in areas currently featuring monocultural systems or in other degraded areas.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

- By 2030, a total of 1000 hectares of agricultural land used for monocultural systems will be converted to agroforestry systems.
- By 2050, a total of 20,000 hectares of agricultural land used for monocultural systems will be converted to agroforestry systems.

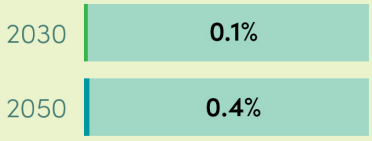
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

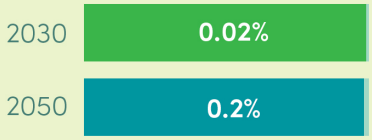
0.9 $TgCO_2e$

AG-1 has a low mitigation potential of **2%** of total emissions in the agriculture and livestock sector.

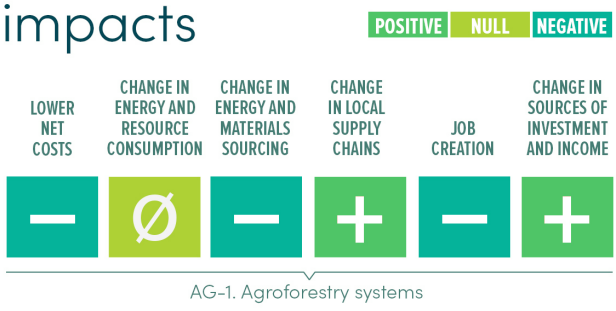
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)



Macroeconomic impacts

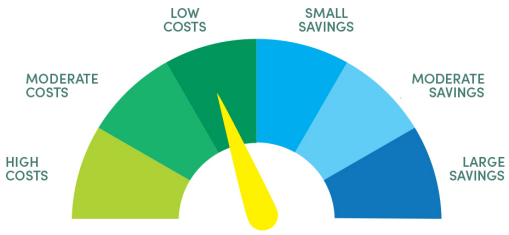


AG-1. Agroforestry systems

Co-benefits

Costs and savings

Low direct costs for the state, as compared to BAU condition, due to the costs of implementing new farming systems.



AG-2. PASTURELAND REGENERATION

DESCRIPTION: This action aims to capture carbon dioxide from the atmosphere as well as to reduce GHG emissions by restoring soil carbon and reduce soil carbon losses in grasslands.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

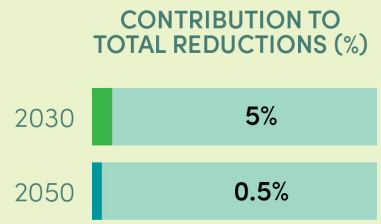
- By 2030, 150,000 hectares of existing grazing land will be regenerated.
- By 2050, 270,000 hectares of existing grazing land will be regenerated.

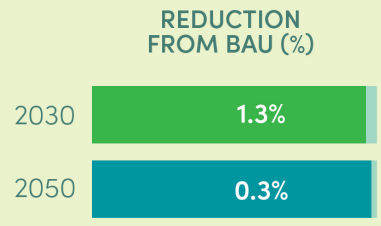
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

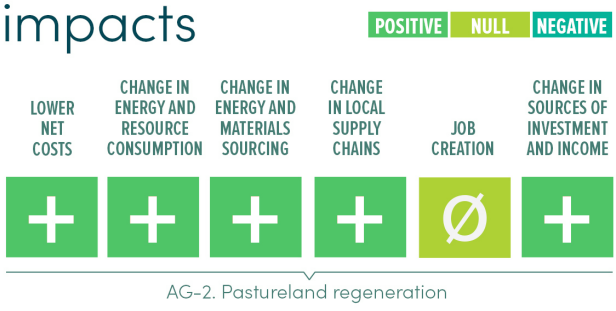
5.4 $TgCO_2e$

AG-2 has a low mitigation potential of **12%** of total emissions in the agriculture and livestock sector.





Macroeconomic impacts



Co-benefits

Costs and savings

Small direct savings due to reduced livestock production costs in the state compared to the BAU scenario.

FOLU-1. FOREST ECOSYSTEM EXPANSION

DESCRIPTION: This action aims to increase the absorption of carbon dioxide from the atmosphere through initiatives that establish new forests on currently non-forested public and/or private lands in the state.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

· By 2030, a total of 10,000 hectares of new forest (a rate of 1000 ha/year) will be established in the state, including coniferous forests, oak forests, lowland forests, shrublands and mesophyll rainforests. They will be established in areas currently without forest and on degraded land.

· By 2050, a total of 30,000 hectares of new forest (a rate of 1000 ha/year) will be established in the state, including coniferous forests, oak forests, lowland forests, shrublands and mesophyll rainforests. They will be established in areas currently without forest and on degraded land.

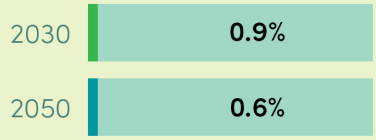
Impact on GHG emissions reduction

Cumulative GHG emission reductions (2022 - 2050):

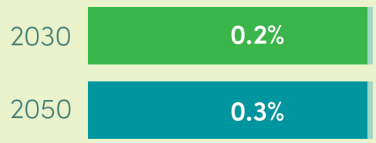
1.8 $TgCO_2e$

FOLU-1 has a very high mitigation potential of **81%** of total emissions in the FOLU sector (forestry and other land uses).

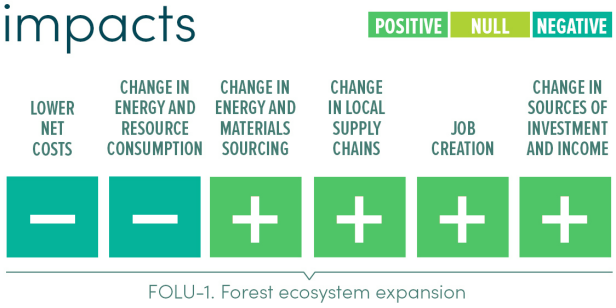
CONTRIBUTION TO TOTAL REDUCTIONS (%)



REDUCTION FROM BAU (%)



Macroeconomic impacts



FOLU-1. Forest ecosystem expansion

Co-benefits

Costs and savings

Small direct costs due to higher land management costs for Querétaro compared to the BAU scenario.

FOLU-2. FOREST CONSERVATION

DESCRIPTION: This action aims to reduce deforestation rates and associated emissions in Querétaro by creating a payment mechanism for environmental services through which owners of existing unprotected forests at high risk of being deforested will be rewarded for conserving forest lands.

LEVEL OF EFFORT AND TIMING OF IMPLEMENTATION:

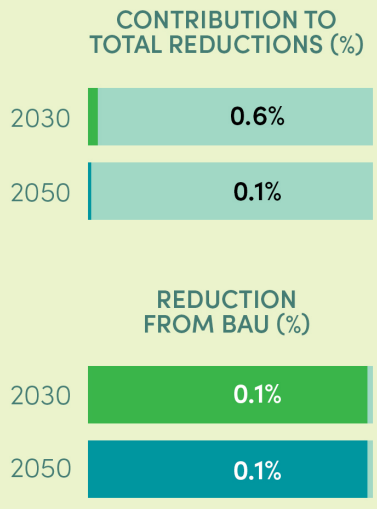
- By 2030, a total of 7,850 hectares of deforestation will be avoided.
- By 2050, a total of 26,100 hectares of deforestation will be avoided.

Impact on GHG emissions reduction

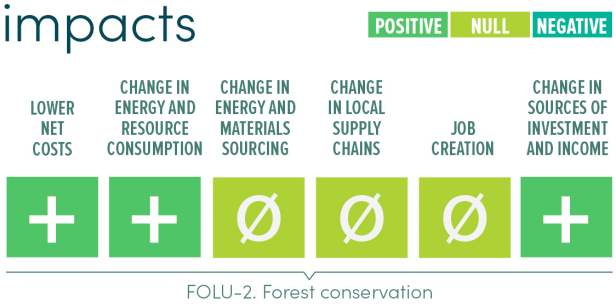
Cumulative GHG emission reductions (2022 - 2050):

0.7 $TgCO_2e$

FOLU-2 has a very high mitigation potential of **32%** of total emissions in the FOLU sector (forestry and other land uses).



Macroeconomic impacts



FOLU-2. Forest conservation

Co-benefits

Costs and savings

Small direct costs due to costs associated with protecting Querétaro's forests that are not present in the BAU scenario.