# Fleet Greening
## Challenges & Opportunities

***2018 CIPMM Fleet Management Workshop***

November 6-7, 2018

Corporate Fleet Services
*Driving Solutions*

# Welcome!

- *Dan Stechysin* – Managing Director
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- CFS is a leading Canadian fleet management consulting firm providing specialized fleet consulting and analysis to public and private sector organizations since 1999.

# Latest News Update

# Latest News Update

# Outline

**Part 1:** GHG Emissions and Fleet Greening

**Part 2:** Green Planning to 2030 and Beyond

**Part 3:** *The Future of Green Vehicles* - Discussion


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# GHG Emissions and Fleet Greening

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# Audience Question 1

Where does the term “Greenhouse Gas” come from?

a. From the idea that these gases are emitted by the vegetation cultivated in greenhouses.

b. From the fact that certain gases trap heat like the glass walls of a greenhouse.

c. Before the Industrial Revolution, these gases were only found in greenhouses, hence the name.

d. Dr. Hans Grünhaus was the one who discovered the effect of these gases on the earth.

SOURCE: The Green House Effect, *National Center for Atmospheric Research*

# Audience Question 2

Is the Greenhouse Effect:

a. Beneficial to life on Earth

b. Detrimental to life on Earth

c. Both A and B

# Audience Question 3

What would be the Earth's average temperature without greenhouse gases?

a. -18°C

b. 0°C

c. +5°C

According to NASA Goddard Institute for Space Studies (GISS) the global mean surface air temperature in 2017 was 14.9 °C. Without GHGs it would be -18 °C.

SOURCE: NASA

# GHG Emissions

- Most GHGs have both natural and human-induced sources
- **Carbon dioxide** $CO_2$ is the best-known GHG (greenhouse gas)

For example, $CO_2$ is produced through both:

- decay of plant and animal matter
- fossil fuel combustion

*Natural source*

*Human-induced source*

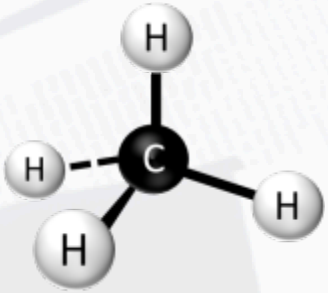
# GHG Emissions

Besides $CO_2$, there are other GHGs:

- water vapour
- methane ($CH_4$)
- nitrous oxide ($N_2O$)
- hydrofluorocarbons (HFCs) etc.

**Carbon Dioxide Equivalent (CDE, $CO_2e$):**

Carbon dioxide equivalent is a measure used to compare the emissions from various greenhouse gases based on their global warming potential.




*For example, the global warming potential for methane over 100 years is 21 times that of $CO_2$.*

# Audience Question 4

Which is the most abundant greenhouse gas in the atmosphere?

a. Carbon dioxide

b. Methane

c. Water vapour

d. Ozone

Although water vapour is the most abundant GHG, the concentration of $CO_2$ contributes to warming of the planet which in turn leads to increased levels of water vapour.

SOURCE: NASA

# Audience Question 5

How much carbon dioxide (CO2) is emitted on average when a vehicle consumes one litre of gasoline?

a. 240 g

b. 800 g

c. 2.3 kg

d. 10 kg

SOURCE: NRCan

# Audience Question 6

What quantity of carbon dioxide ($CO_2$), on average, does a human being emit through breathing each day?

a. 10 g

b. 100 g

c. 1 kg

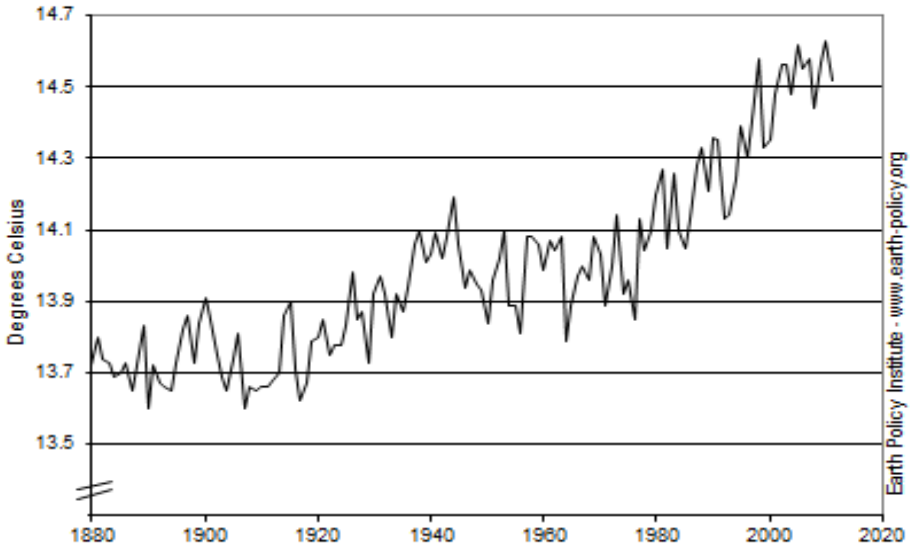
d. 5 kg

SOURCE: The Global Learning and Observations to Benefit the Environment (GLOBE) Program - Globe.gov

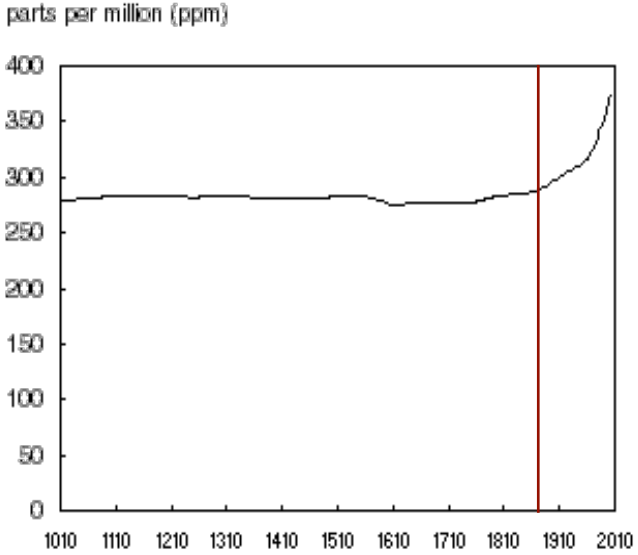
# Climate Change

## Weather vs. Climate

Average Global Temperature, 1880-2010




Atmospheric carbon dioxide concentration




SOURCE: NASA GISS & *Statistics Canada*

# Air Pollution

**CACs (criteria air contaminants) are pollutants, mainly to blame for respiratory and health problems, smog and poor air quality**

Main CACs from vehicle exhaust include:

- Carbon monoxide (CO)
- Particulate matter (PM)
- Ozone ($O_3$)
- Sulfur oxides (SOx)
- Nitrogen oxides (NOx)

**CAC usually have a localized effect in large urban areas whereas GHGs act globally**

# Audience Question 7

How did Canada's total GHG emissions in 2015 compare to the emissions in 1990?

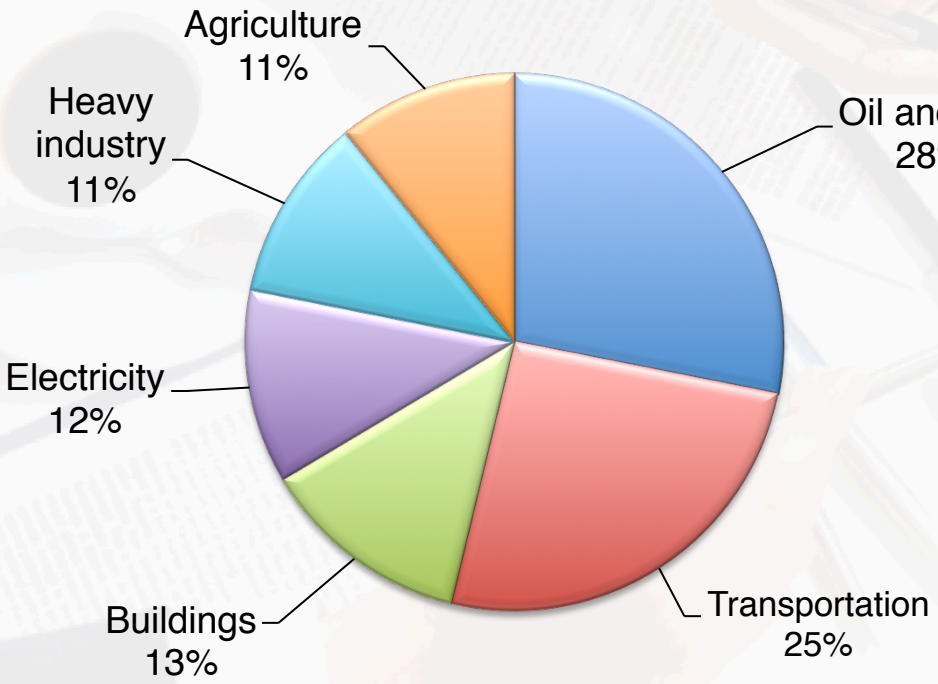
a. Increased by 18%
b. Increased by 8%
c. Remained unchanged
d. Decreased by 21%

According to NRCan, Canada's GHG emissions increased by 18% mainly due to fossil fuels and the transportation sector.

SOURCE: NRCan

# GHG Emissions in Canada

**Greenhouse gas emissions by Canadian economic sector in 2015**




DATA SOURCE: *NRCan*

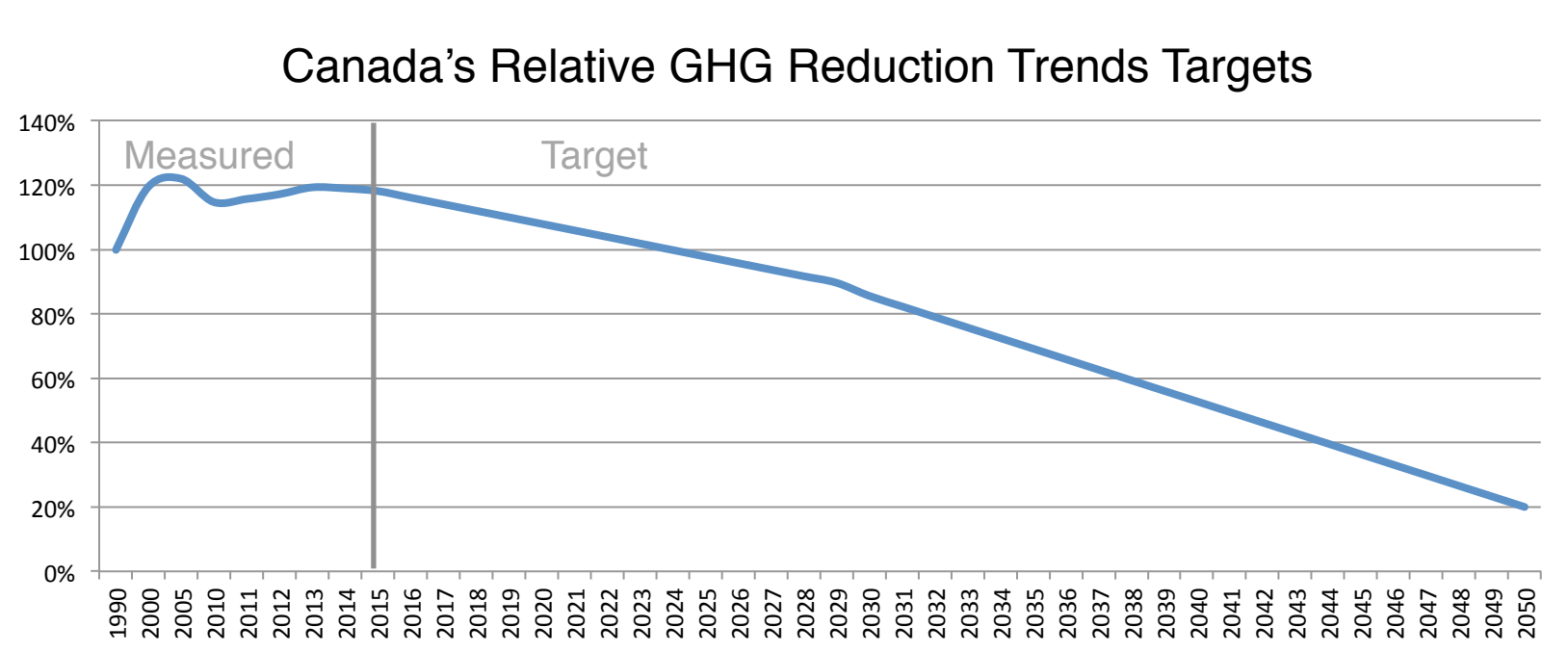
# Paris Climate Agreement

- The Paris Accord is an agreement on climate change with a goal of **keeping global warming below two degrees Celsius compared with pre-industrial times**.

- Only two countries in the world are not part of the agreement or have chosen to withdraw:
  1. The Holy See (The Vatican)
  2. The United States of America

**Canada's target: 30-percent reduction in emissions from 2005 levels by 2030**

# Federal GHG Emissions Reduction Plans




DATA SOURCE: *NRCan*

**Federal Government Emissions Reduction Targets:**

- 30% below 2005 by 2030
- 80% below 2005 by 2050

# Green Vehicle Technologies

## Hybrid (HEV)

- ✓ Only uses regenerative electric propulsion
- ✓ Improves fuel economy, not an electric vehicle

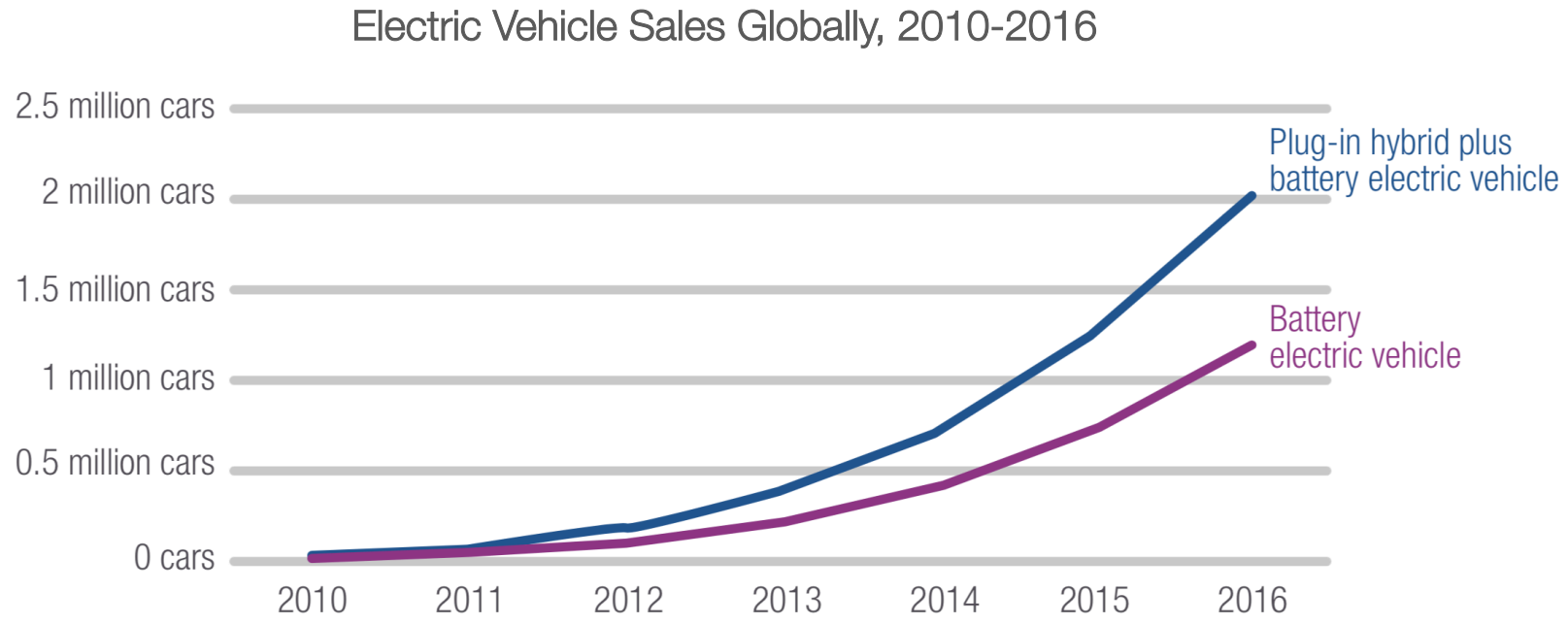
## Plug-in Hybrid (PHEV)

- ✓ Functions like a regular hybrid but the battery can be recharged
- ✓ Transition technology, limited electric range (<60 km)

## Battery Electric (BEV)

- ✓ Battery only, extended electric range (>200 km)
- ✓ Long vehicle life due to few moving parts
- ✓ Zero emissions

# Green Vehicle Technologies




Source: IEA Analysis, 2017*

SOURCE: Report *Design and Test Solutions for Electro Mobility (E-Mobility) Applications* by Keysight Technologies, 2018

# Electric Vehicles on the Canadian Market

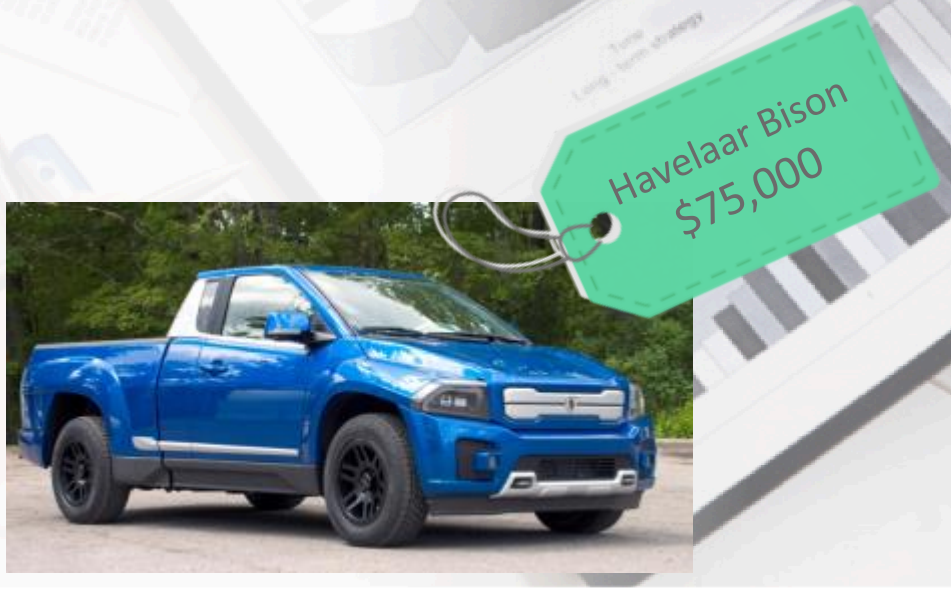
| Hybrid (HEV) | Plug-in Hybrid (PHEV) | Battery Electric (BEV) |
|---|---|---|
| Ford Fusion Hybrid | Chevy Volt | BMW i3 |
| Honda Accord Hybrid | Ford C-Max Energi | Chevy Bolt |
| Infiniti Q50 Hybrid | Ford Fusion Energi | Ford Focus Electric |
| Kia Optima Hybrid | Honda Clarity PHEV | Hyundai Ioniq BEV |
| Toyota Prius | Hyundai Ioniq PHEV | Kia Soul BEV |
| | Hyundai Sonata PHEV | Nissan Leaf |
| | Kia Niro PHEV | Smart Electric Drive |
| **SUV/ Minivan:** | Kia Optima PHEV | Tesla Model 3 |
| Subaru XV Crosstrek Hybrid | Toyota Prius Prime Plug-in | Volkswagen e-Golf |
| Toyota Highlander Hybrid | Chrysler Pacifica PHEV | |
| Toyota RAV4 Hybrid | Mitsubishi Outlander PHEV | |

*Includes vehicles with starting MSRP below $60,000

# Emerging Technologies

## Electric pick-up trucks

- Workhorse W-15 PHEV
- Havelaar Bison BEV
- Chevrolet Silverado
- Ford F-150 PHEV (2020)
- Tesla pick-up trucks BEV

# Emerging Technologies

## Electric vans and SUVs

- Bollinger B1 and B2 BEV
- Nissan E-NV200 PHEV (currently in Europe)
- Mercedes E-sprinter BEV (2019)


# Emerging Technologies

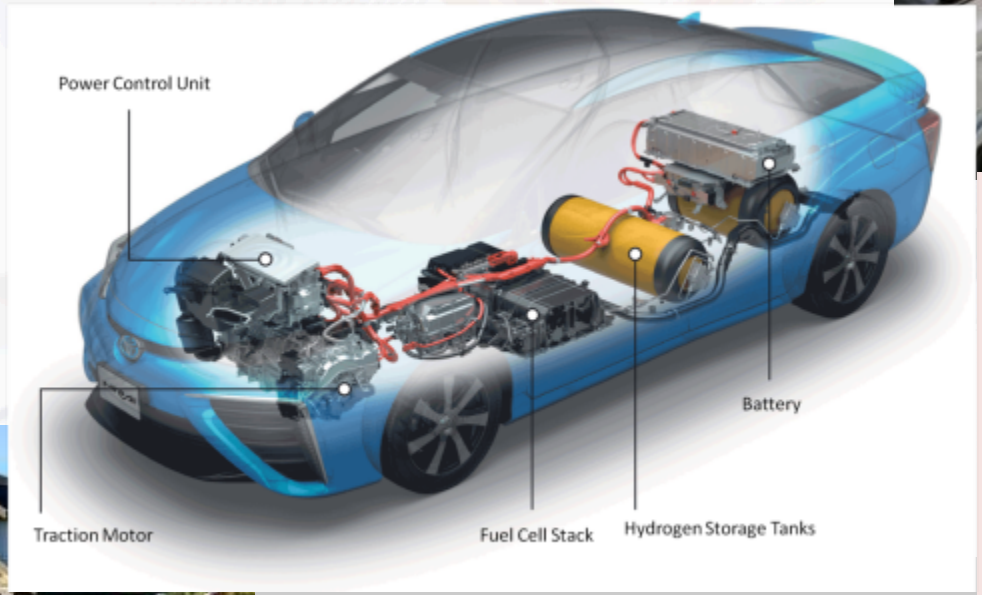
## Using existing vehicle platforms

- Rivian Pickup-truck PHEV
- Via Motors Van PHEV
- Zenith Electric Cargo & Passenger Vans PHEV



# Emerging Technologies

## Fuel cell vehicles


For comparison, there are 40 fuelling stations in the US, majority of them in California

According to NRCan, there are only **two** hydrogen fuelling stations in Canada, both are non-retail and located in the Vancouver area.

# Audience Question 8

Which province produces most of its electricity from coal?

a. Alberta

b. Saskatchewan

c. Ontario

In Saskatchewan, nearly 49% of electricity supply come from coal.

SOURCE: NRCan

# Audience Question 9

Which province produces most of its electrical power from hydroelectric sources?

a. Quebec

b. Newfoundland and Labrador

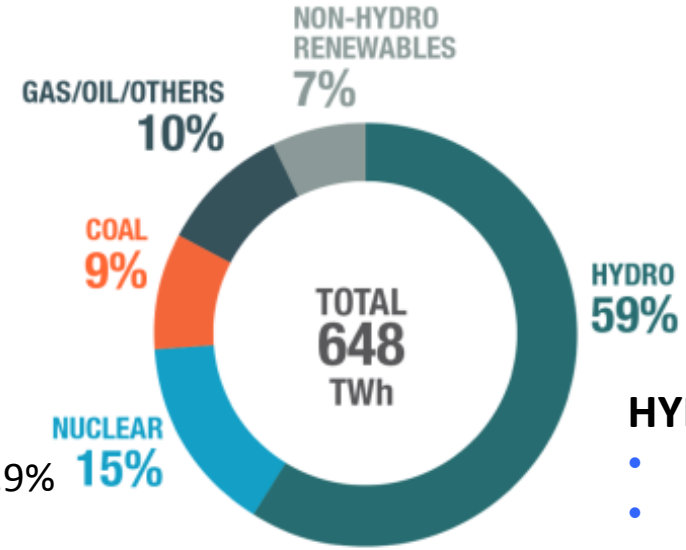
c. Manitoba

In Manitoba, 97% of electricity is produced from hydro.

SOURCE: NRCan

# Electricity Production

**Electricity Generation in Canada by Source, 2016**




**COAL:**

- Saskatchewan: 48.9%
- Alberta: 48.5%
- Nova Scotia: 48.5%

**HYDRO:**

- Manitoba: 97.0%
- Quebec: 95.3%
- Newfoundland and Labrador: 94.3%
- Yukon: 93.7%
- British Columbia: 89.4%

SOURCE: National Energy Board

# Green Planning to 2030 and Beyond

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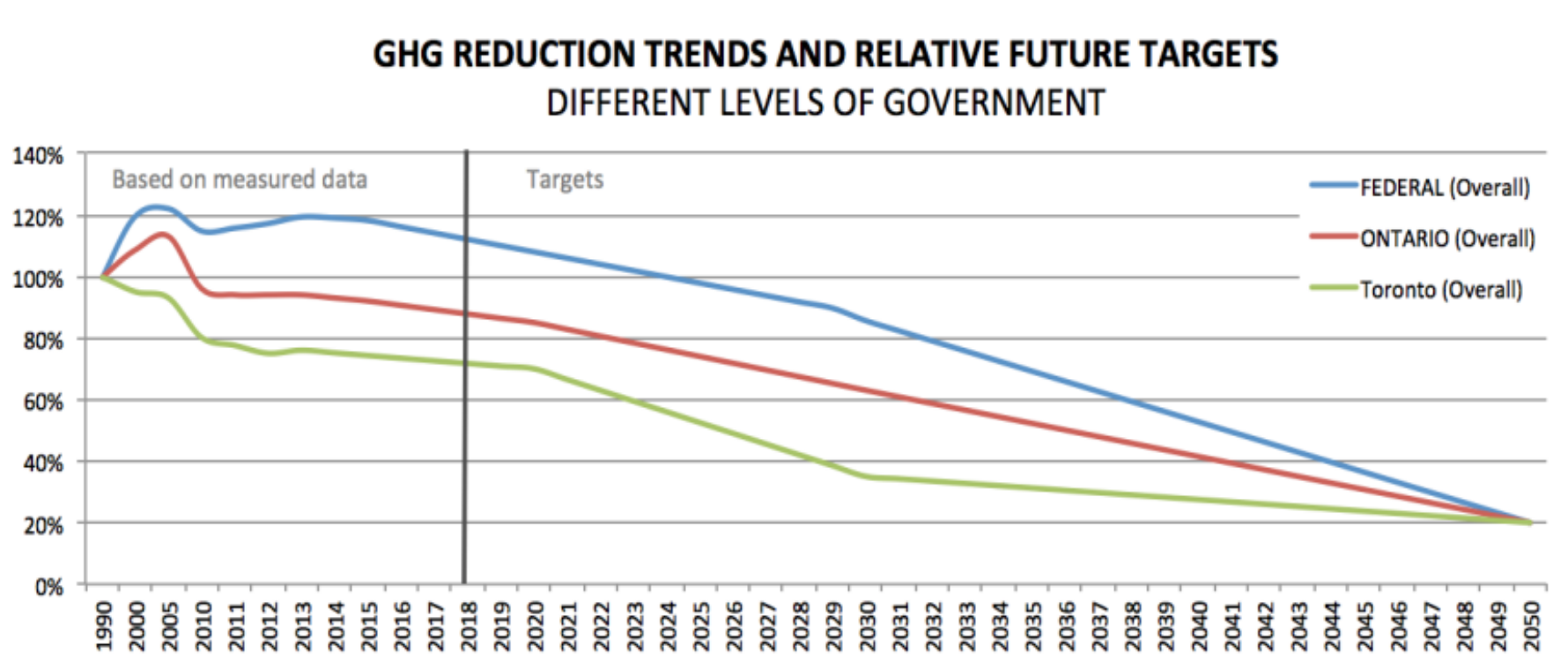
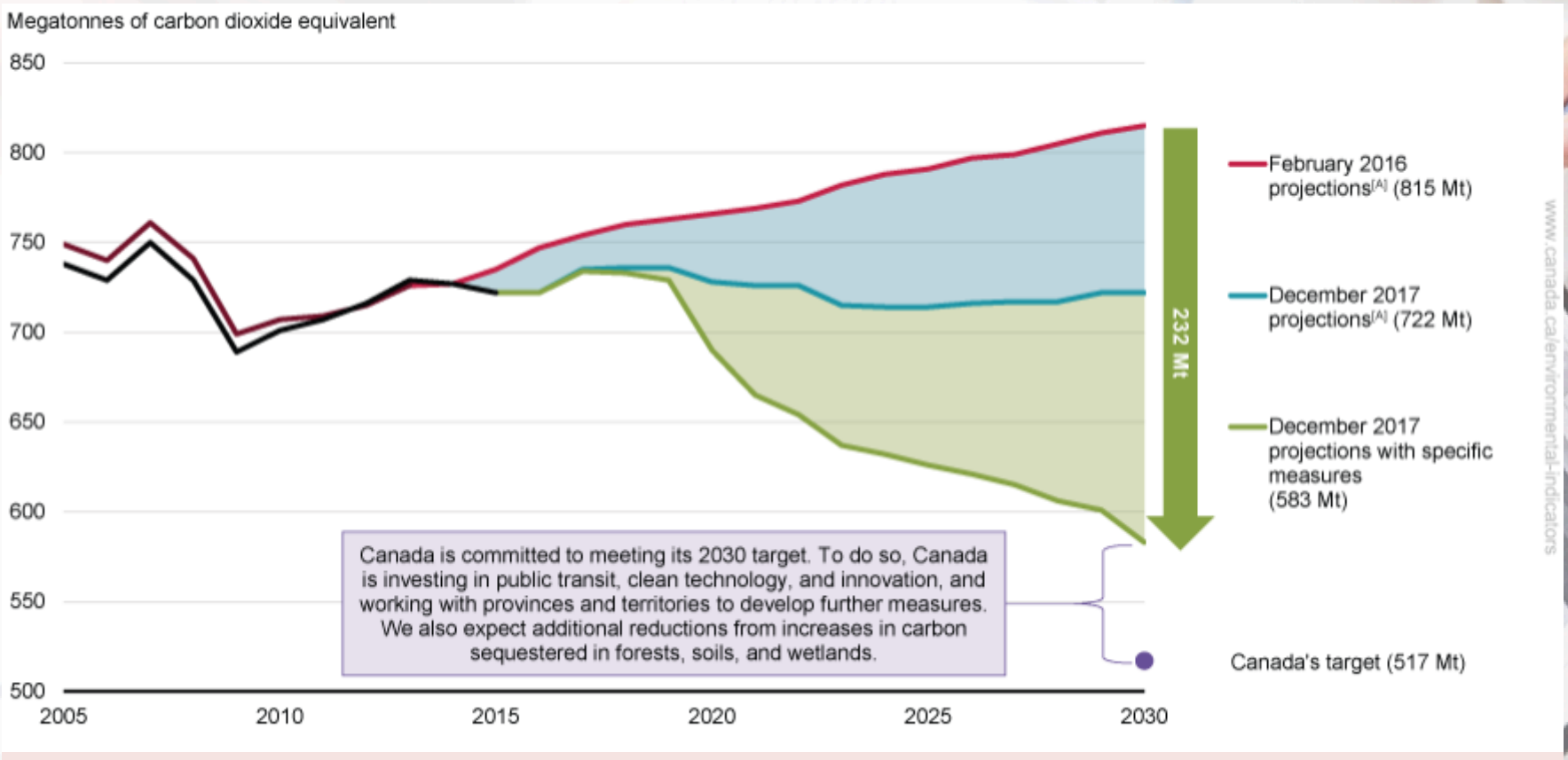
# Current Green Fleets and Future Trends



# Canada's GHG Emissions Trends




**Current emissions reductions are not on track**

SOURCE: Report *Canadian Environmental Sustainability Indicators - Progress towards Canada's greenhouse gas emissions reduction target*, January 2018

# IPCC – Intergovernmental Panel on Climate Change 2018 Report

## Limit the global temperature increase to 1.5°C above pre-industrial times

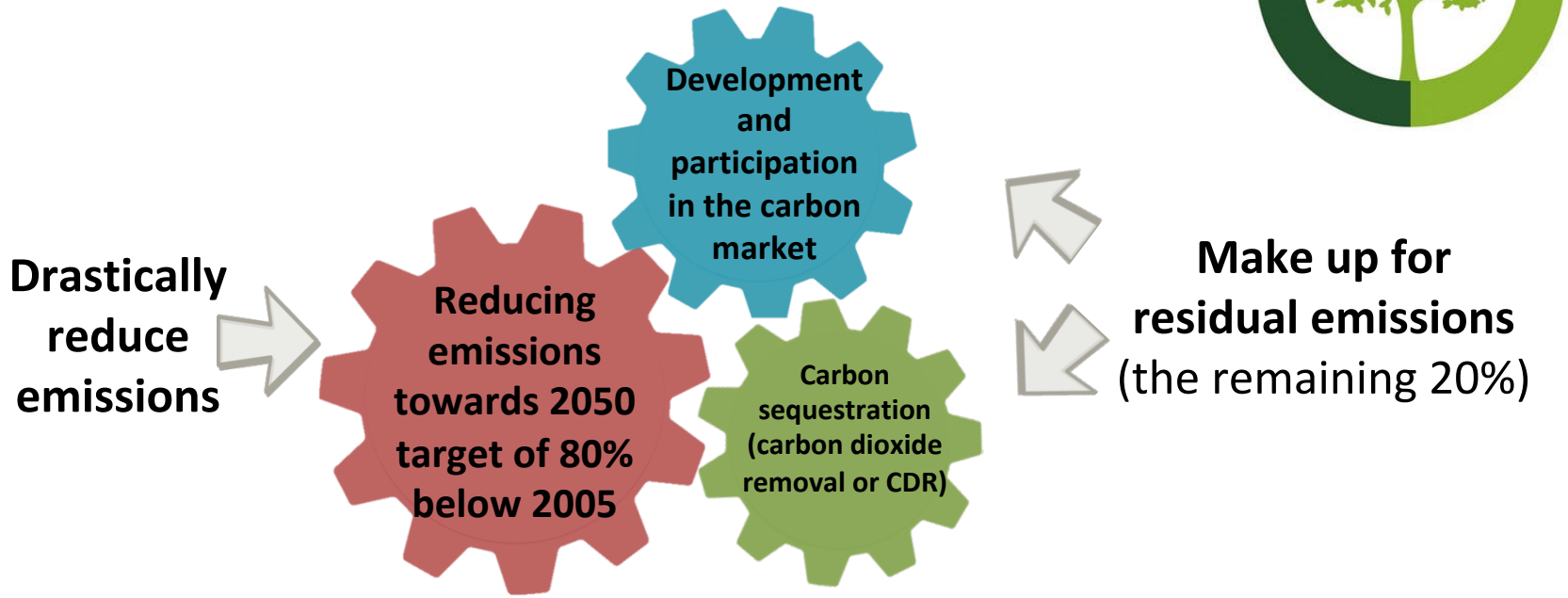
In order to achieve that, world human-generated $CO_2$ emissions must:

- decline by about 45% from 2010 levels by 2030
- eliminate coal-generated electricity by 2050
- reach net zero around 2050 (be carbon-neutral)
- 85% of electricity must be renewable by 2050
- 7 million sq km of land will be needed for energy crops (a land mass roughly the size of Australia)

# Carbon Neutrality

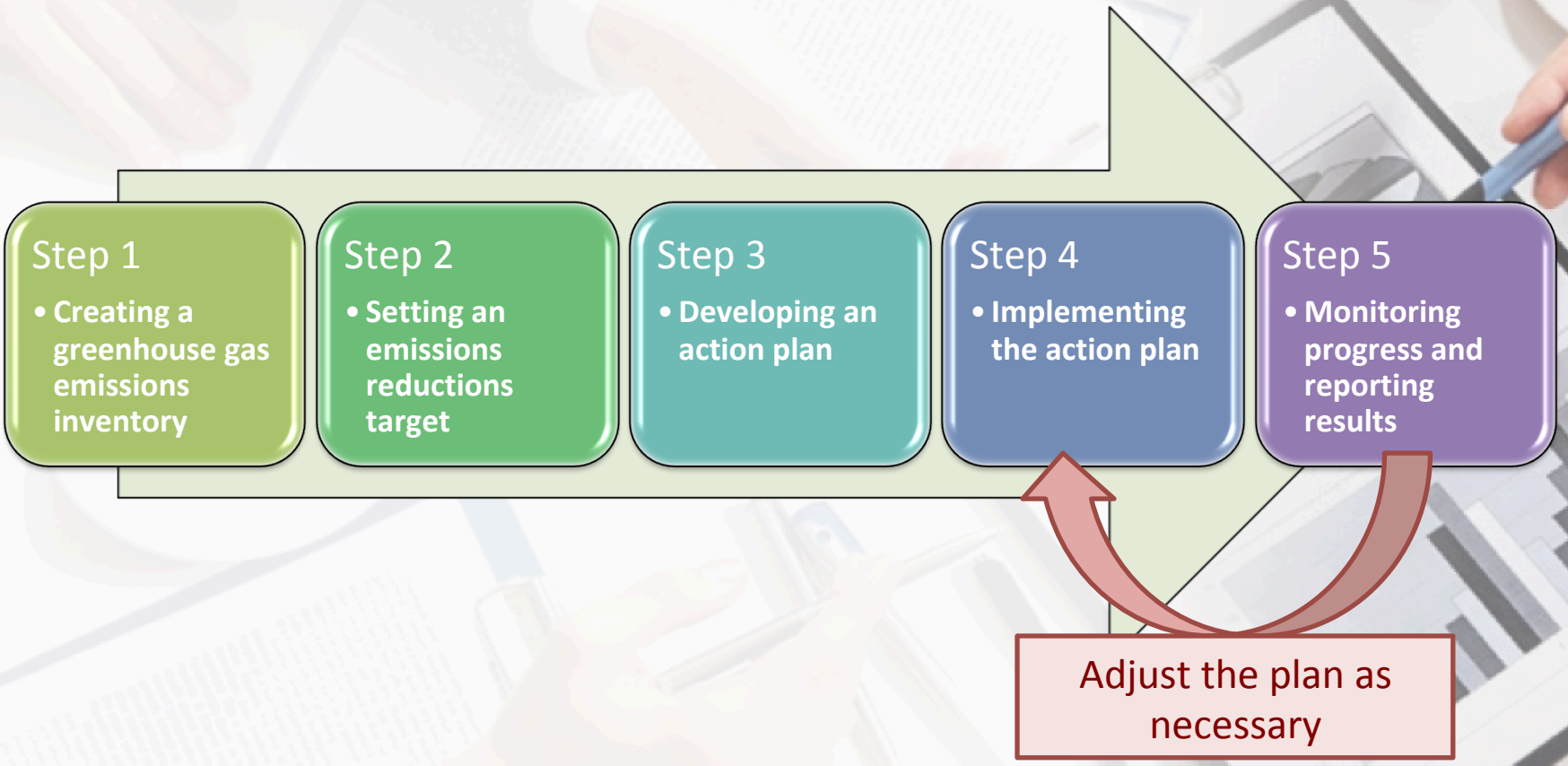
## The goal for Canada: carbon neutrality

$CO_2$ emitted = $CO_2$ absorbed




**The Federal government is uniquely positioned to achieve carbon-neutrality and act as a leader in reducing GHGs at both the corporate and community levels**

# Steps Towards Consistent Emissions Reduction




**Based on** the Federation of Canadian Municipalities' Partners for Climate Protection Protocol *Five-Milestone Framework*

# Current Emissions

Step 1

- **Creating a greenhouse gas emissions inventory**

- Calculate your fleets total fuel consumption – for the fleet overall or, ideally, per-vehicle
- Calculate emissions from the fuel consumed

***PCP Protocol*** is a good tool for determining emissions

**RESULT: Establish fleet emissions baseline**

# Setting Targets

## Step 2

- **Setting an emissions reductions target**

① Engage in consultations with stakeholders

② Set a formal emissions reduction target for the departmental fleet as a whole

③ Define targets based on the different parts of the fleet (e.g. trucks versus compact vehicles)

# Setting Targets

**Throughout the process, consult the stakeholders**

- ✓Awareness raising
- ✓Personal involvement
- ✓Chance to express suggestions,  concerns, address issues

# Creating a Plan

## Step 3

- **Developing an action plan**

Determine availability of green vehicles, alternative fuels and fuelling/charging infrastructure

Integrate greening technologies (start-stop technology, mild hybrids)

Adopt GHG reduction initiatives (driver training, route optimization, pooling, anti-idling policies)

# Creating a Plan

## Step 3 (*continued*)

- **Developing an action plan**

**Develop a fleet replacement plan based on:**

- operational feasibility
- fleet right-sizing
- budget

- ✓ *Fuel Costs*
- ✓ *Vehicle Capital Costs*
- ✓ *New/Additional Infrastructure Costs*
- ✓ *Training required to use the technology*

**Consider vehicle classes or a vehicle-by-vehicle approach**

# Creating a Plan

## Step 3 (*continued*)

- **Developing an action plan**

**Determine implementation strategies:**

- monitoring progress
- responsibilities
- schedules
- funding sources

# Available Green Vehicles

## Under $50,000 MSRP

| BEV Compact | Model | Type | MSRP (starting at) |
|---|---|---|---|
| smart | fortwo Electric | BEV | $29,050 |
| Ford | Focus Electric | BEV | $34,998 |
| Hyundai | IONIQ Electric | BEV | $35,649 |
| Kia | Soul Electric | BEV | $35,895 |
| Nissan | LEAF | BEV | $35,998 |
| Volkswagen | e-Golf | BEV | $36,355 |
| Chevrolet | BOLT | BEV | $43,195 |
| Tesla | Model 3 | BEV | $45,600 |
| BMW | i3 | BEV | $48,750 |

| PHEV Compact | Model | Type | MSRP (starting at) |
|---|---|---|---|
| Hyundai | IONIQ PHEV | PHEV | $31,999 |
| Toyota | Prius Prime | PHEV | $32,990 |
| Ford | Fusion Energi | PHEV | $33,588 |
| Chevrolet | VOLT | PHEV | $39,095 |
| Honda | Clarity PHEV | PHEV | $39,900 |
| Audi | A3 Sportback e-tron | PHEV | $40,900 |
| Kia | Optima PHEV | PHEV | $42,995 |
| Mitsubishi | Outlander PHEV | PHEV | $42,998 |
| MINI | Cooper Countryman S | PHEV | $43,490 |
| Hyundai | Sonata PHEV | PHEV | $43,999 |

**The Federal Government does not benefit from provincial incentive programs for green vehicles**

# Fleet Greening Solutions to Consider

- **Other Greening Initiatives:**
  - Anti-idling technologies (start/stop technology)
  - Anti-idling policy and incentives programs
  - Technician and driver eco-training
  - Route optimization

Whenever operationally feasible, choose **SMALLER & LIGHTER VEHICLES**

# Fleet Greening Solutions to Consider

| Greening Solution | Greening potential |
| --- | --- |
| **Alternative fuels** | |
|  | |
| **Green vehicles** | |
|  | |

# Fleet Greening Solutions to Consider

| | Greening Solution | Fuel cost compared to current | Number of fuelling stations in Canada |
|---|---|---|---|
| **Alternative fuels** | Hydrogen Fuel Cell | **40% less** | **2** |
|  | RNG - Renewable Natural Gas | **19% less** | **0** |
| | Ethanol E85 | **32% more** | **0** |
| | Biodiesel B20 | **1% less** | **2** |
| | CNG - Compressed Natural Gas | **28% less** | **36** |
| | Propane (LPG) | **44% less** | **839** |
| **Green vehicles** | BEV – battery electric vehicles | **75% less** | **3070 - Level 2<br>503 - Level 3** |
|  | PHEV – plug-in hybrid electric | **63% less** | **Same as BEVs** |
| | HEV – hybrid electric | **30% less** | **Not applicable** |
| | MHEV – mild hybrid electric | **10% less** | **Not applicable** |

# Fleet Greening Solutions to Consider

| | Greening Solution | Vehicle cost investment | Infrastructure investment |
|---|---|---|---|
| **Alternative fuels** | Hydrogen Fuel Cell | **Medium** | **High** |
|  | RNG - Renewable Natural Gas | **High** | **High** |
| | Ethanol E85 | **Low** | **Low** |
| | Biodiesel B20 | **Low** | **Low** |
| | CNG - Compressed Natural Gas | **High** | **High** |
| | Propane (LPG) | **Medium** | **Low** |
| **Green vehicles** | BEV – battery electric vehicles | **Medium** | **Low** |
|  | PHEV – plug-in hybrid electric | **Medium** | **Low** |
| | HEV – hybrid electric | **Low** | **None** |
| | MHEV – mild hybrid electric | **Low** | **None** |

# Benefits and Challenges of EVs

## Benefits

- ✓ Life-cycle cost savings
- ✓ Longer vehicle replacement cycles
- ✓ Only viable alternative to meet aggressive targets

## Challenges

- ○ Limited current application (compact cars – administration, security)
- ○ Limited range
- ○ Long charging time

# Implementing the Plan

## Step 4

- **Implementing the action plan**

Staffing and internal communications

Adhering to the project timelines

Balancing the fleet budget

Stakeholder engagement

# Tracking Progress

## Step 5

- **Monitoring progress and reporting results**

- ✓ Track results of specific emission reduction measures
- ✓ Engage stakeholders and decision-makers
- ✓ Update the emissions inventory
- ✓ Report on progress

**Adjust the plan as necessary to meet the set targets**

# In Conclusion

- ✓ Reducing emissions is possible
- ✓ Technologies and the market are catching up
- ✓ Demand will drive supply in the EV market
- ✓ The Federal Government can play a critical role

**Change is happening and it is positive**

# DISCUSSION

*“The Future of Green Vehicles”*

Corporate Fleet Services
Driving Solutions

# Application to the Federal Fleet

## Feedback from participants

- ✓ infrastructure availability
- ✓ life-cycle costs
- ✓ budgeting for fleet greening
- ✓ challenges and timelines
- ✓ policies and commitments
- ✓ vehicle availability

Discussion

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# Thank you!

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