A close-up photograph of a person's hands cupped together, holding a large quantity of light-brown wood pellets. A single, vibrant green leaf is placed on top of the pellets, symbolizing sustainability and renewable energy. The background is softly blurred, showing a person wearing a light-colored sweater.

# Net Zero Energy Systems

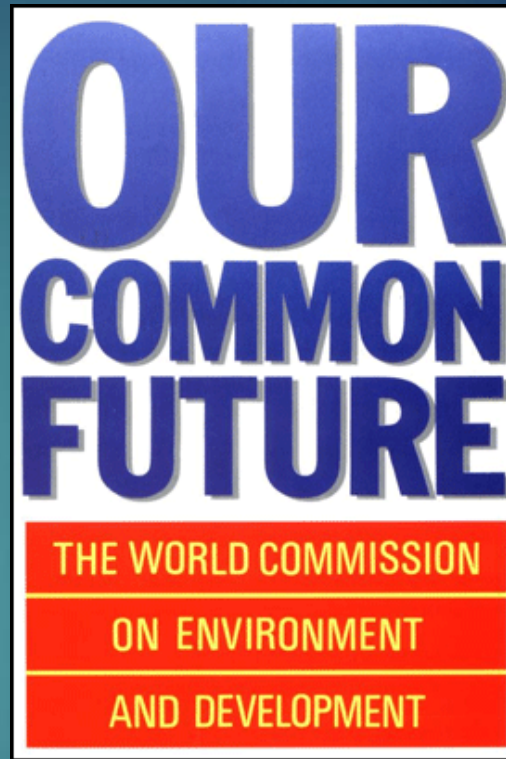
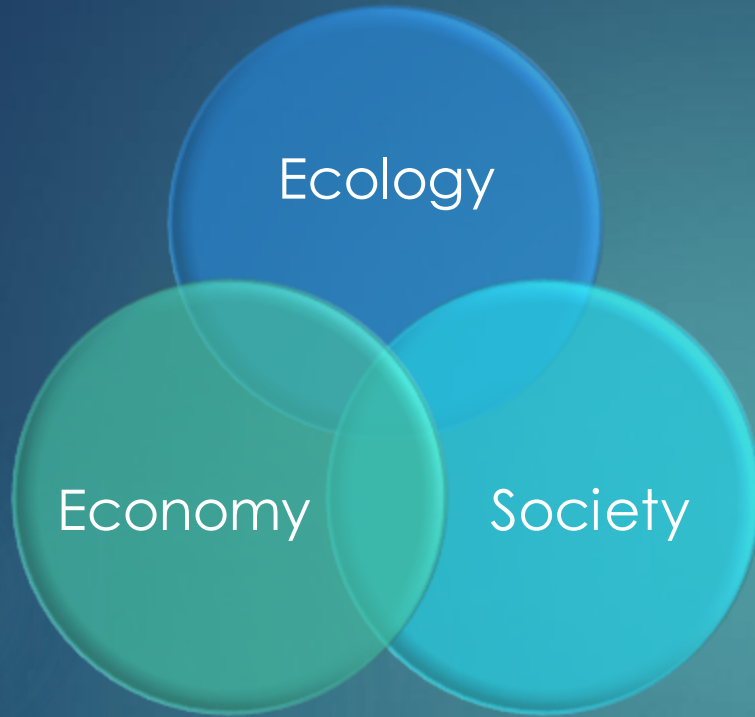
BRUCE LOURIE, PHD

WOOD PELLET ASSOCIATION  
OF CANADA

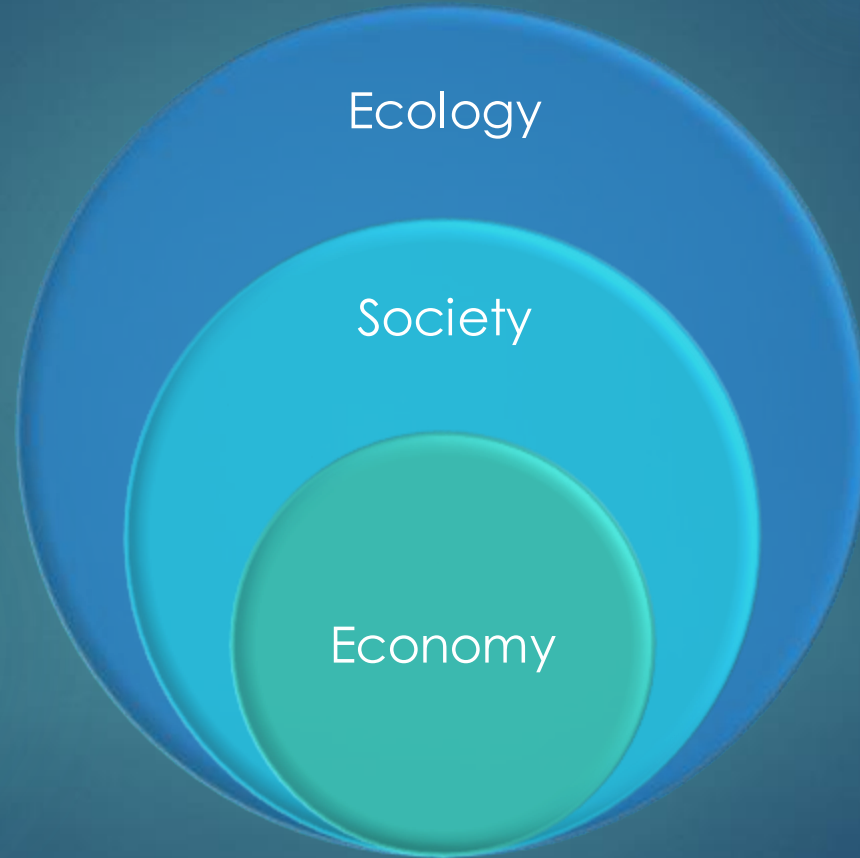
SEPTEMBER 2023

# Overview

- ▶ Sustainability trends – How are we doing?
- ▶ Climate risk, net zero and Canada's progress
- ▶ Net Zero Energy Systems
- ▶ Takeaway messages

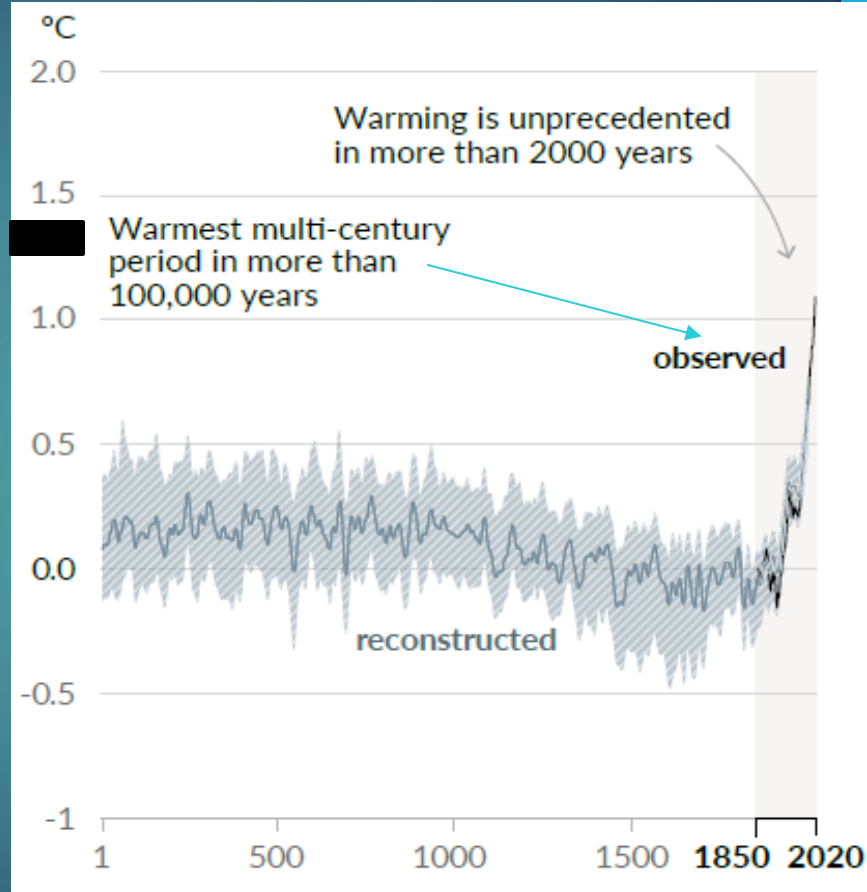


“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs”



Climate science tells us:  
The problem is **urgent**.  
The problem is **real**, and  
caused by human  
activities

Clearly science isn't  
enough...



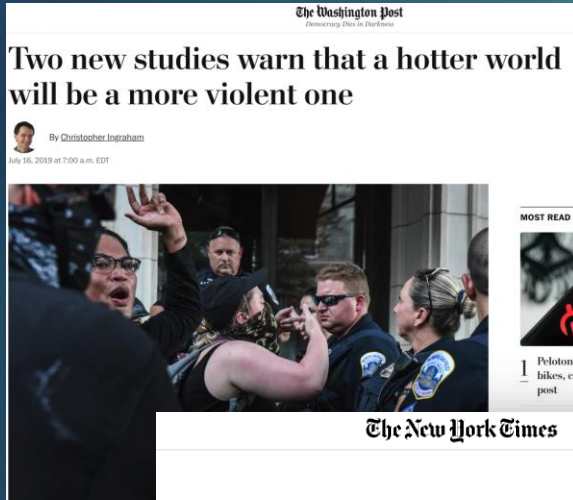


Which of the following does climate change impact?


- a. Violent crime rates
- b. Anxiety and depression
- c. Investment decisions
- d. The price of wine
- e. Where people live
- f. All of the above

More heat = higher rates of aggression and violent crime.

Anxiety and depression levels increase with the existential threat of climate change.



Climate impacts every part of the economy, including where/how investments are made.

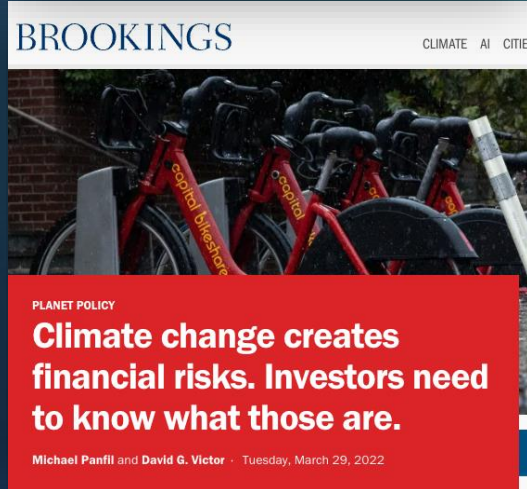


THE GLOBE AND MAIL


FOUR GLOBE CANADA WORLD BUSINESS INVESTING WATCHLIST PERSONAL FINANCE OPINION POLITICS SPORT

PODCAST

### How climate anxiety is shaping small and large financial decisions

BROOKINGS CLIMATE AI CITIES



PLANET POLICY

## Climate change creates financial risks. Investors need to know what those are.

Michael Panfil and David G. Victor · Tuesday, March 29, 2022

Hotter temperatures will change where we can grow certain crops.

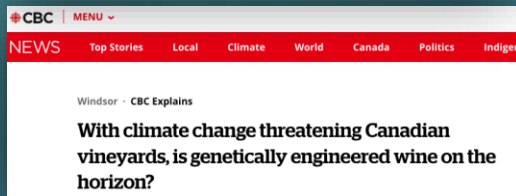


CBC MENU

NEWS Top Stories Local Climate World Canada Politics

Business

### Time to buy more Canadian wine? Climate change driving up prices from other wine regions



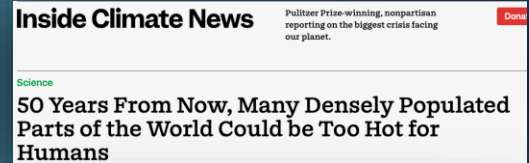
CBC MENU

NEWS Top Stories Local Climate World Canada Politics Indigenous

Windsor · CBC Explains

### With climate change threatening Canadian vineyards, is genetically engineered wine on the horizon?

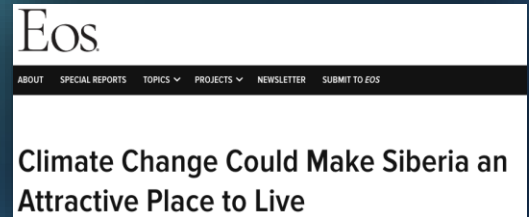
Some areas will become more livable, others will become unlivable.



Inside Climate News Pulitzer Prize-winning, nonpartisan reporting on the biggest crisis facing our planet. Donate

Science

### 50 Years From Now, Many Densely Populated Parts of the World Could be Too Hot for Humans



Eos

ABOUT SPECIAL REPORTS TOPICS PROJECTS NEWSLETTER SUBMIT TO EOS

### Climate Change Could Make Siberia an Attractive Place to Live



Climate change and its impacts are already here: These will intensify if we do not act.

**The Guardian**

### World's largest skating rink on thin ice as Canada's warm winter prevents opening

Mild temperatures in Ottawa make it too dangerous to open Rideau Canal Skateway, the capital's 7.8km long 'blockbuster' attraction



### Judge says Ontario's weak climate plans increase risk of death for the young

Canadian youth activists' case nevertheless dismissed as judge rules province's policies do not violate Charter rights



### Canada's Alberta announces state of emergency over wildfires

Almost all of Alberta and much of neighbouring Saskatchewan province face extreme fire risks.



ENVIRONMENT

### Carbon emissions are costing Canadians 5 times what Ottawa once thought: minister

By Mia Rabson • The Canadian Press

Posted April 19, 2023 4:31 pm · Updated April 19, 2023 4:35 pm

# Vancouver Sun

Chief coroner reports hundreds died from heat over past five days - wildfire takes control of Lytton

10

As of September 15, 2023  
6,317 fires had burned  
173,598 square kilometres  
(67,027 sq mi; 42,897,000  
acres), about 5% of the entire  
forest area of Canada and more  
than six times the long-term  
average



Lytton, BC – June 2021

# Doing nothing is expensive!

## Re-thinking affordability

- ▶ US\$13.6 billion/year in damage to homes and buildings
- ▶ US\$12.8 billion/year in damage to roads and railways
- ▶ US\$4.1 billion/year in damage to electric grid
- ▶ Some costs unquantifiable – health costs, social services, human suffering

Abbotsford, BC – November 2021



# In fact, inaction is more costly than action

## The Physical Costs of Climate Change to Canada

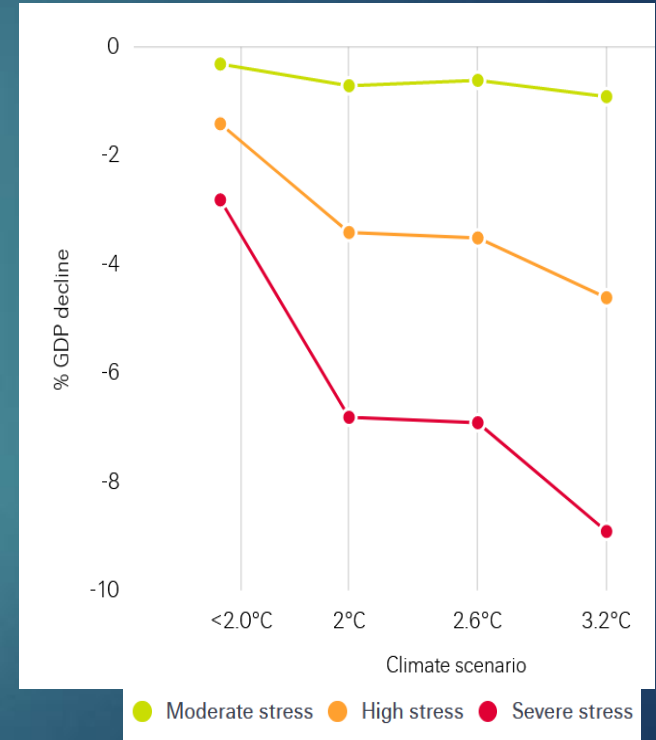
(Cumulative total by 2100 in \$billions)

2°C	\$2,772.78
3°C	\$3,635.65
4°C	\$4,794.57
5°C	\$5,520.06

Source: Institute for Sustainable Finance, The Physical Cost of Climate Change: A Canadian Perspective, 2022



## GDP loss by 2048 from climate impacts



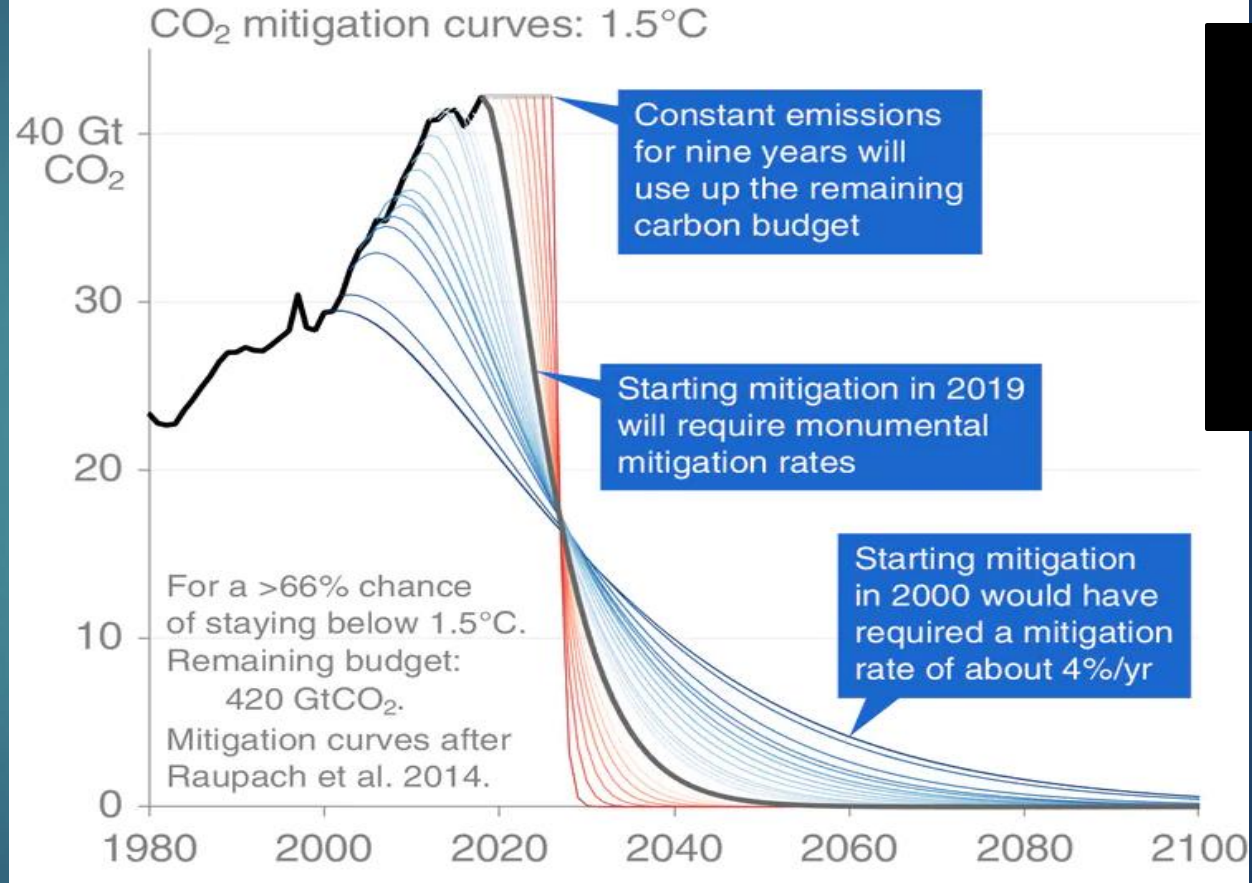
Swiss Re Institute, 2021

# Risks to life and infrastructure

- ▶ Heat events
- ▶ Floods
- ▶ Violent storms
- ▶ Crop and farm damage
- ▶ Electricity system overload
- ▶ Blackouts and brownouts
- ▶ Stranded remote access to health and other services



The longer we delay, the greater the challenge



A photograph of a young child in a bright red long-sleeved shirt and purple pants, crouching on a vast expanse of cracked, dry earth. The ground is parched and broken into irregular, angular blocks, illustrating the severe impact of drought. The child is looking down at the ground, possibly searching for water or food. The background is a continuous field of this cracked earth, extending to the horizon under a clear sky.

# Climate risk = human risk

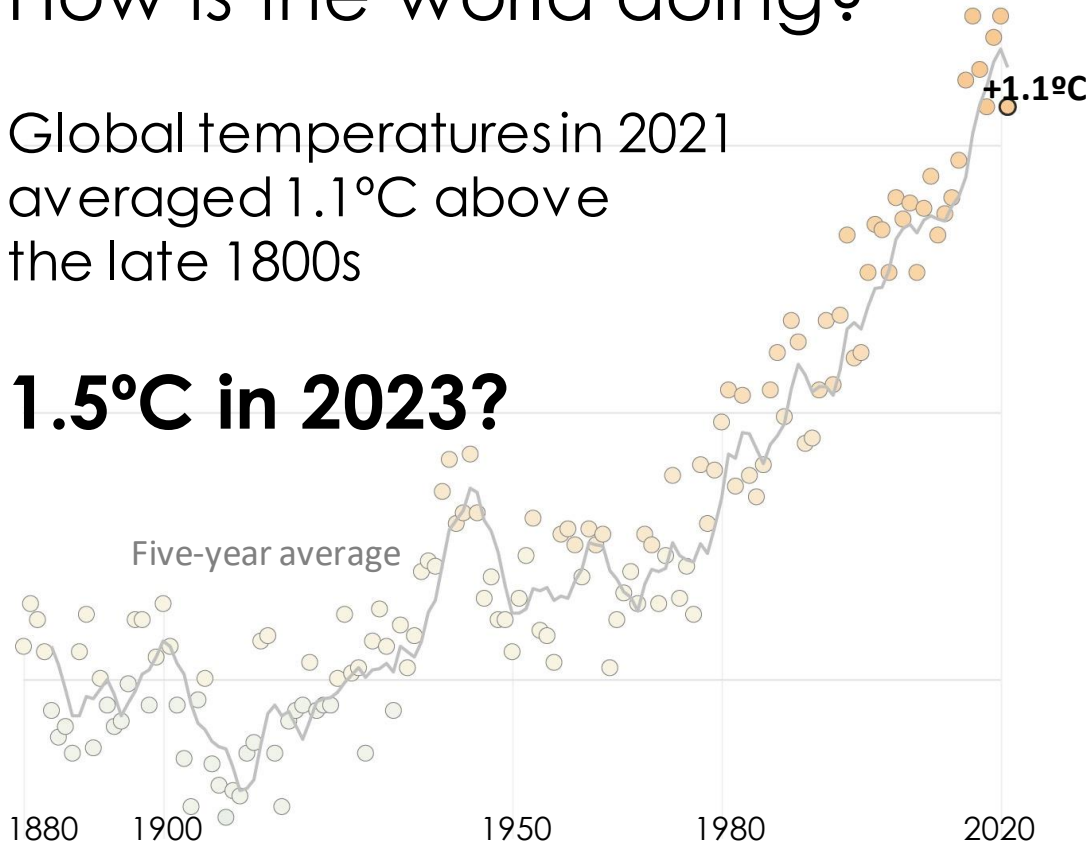
the impact of a 1.5C increase in global temperatures will "disproportionately affect disadvantaged and vulnerable populations through **food insecurity, income losses, lost livelihood opportunities, adverse health impacts, and population displacements**".

- IPCC Report 2018

# How is the world doing?

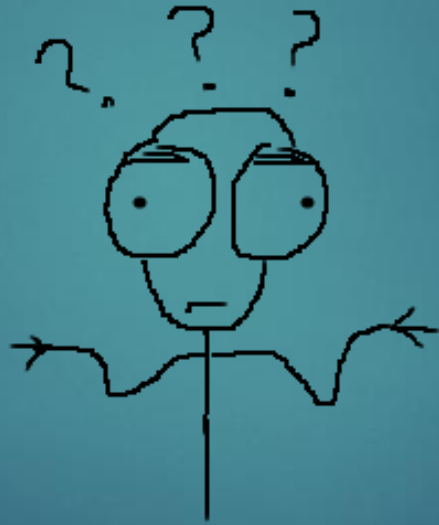
Global temperatures in 2021 averaged  $1.1^{\circ}\text{C}$  above the late 1800s

**$1.5^{\circ}\text{C}$  in 2023?**





Given what we know, why don't we act?



The picture's pretty bleak, gentlemen... the world's climates are changing, the mammals are taking over, and we all have a brain about the size of a walnut.





# Live Poll: Canada's climate engagement



1. By how much has Canada reduced its emissions since 2005?

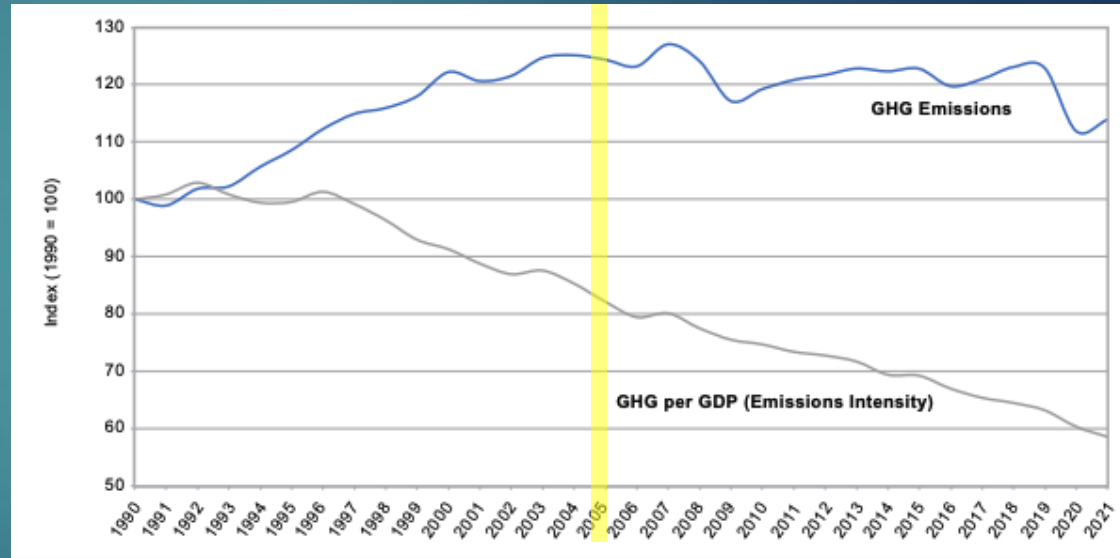
- a. They have risen
- b. By almost nothing
- c. Modestly
- d. Substantially

# Question 1

By how much has Canada reduced its emissions since 2005?

[C] Canada has reduced its emissions by 8.4% from 2005 levels

- ▶ 670 megatonnes (MT) in 2021 vs 732 MT in 2005
- ▶ Equivalent to **13.9% above** 1990 levels





## 2. Which climate targets has Canada met?

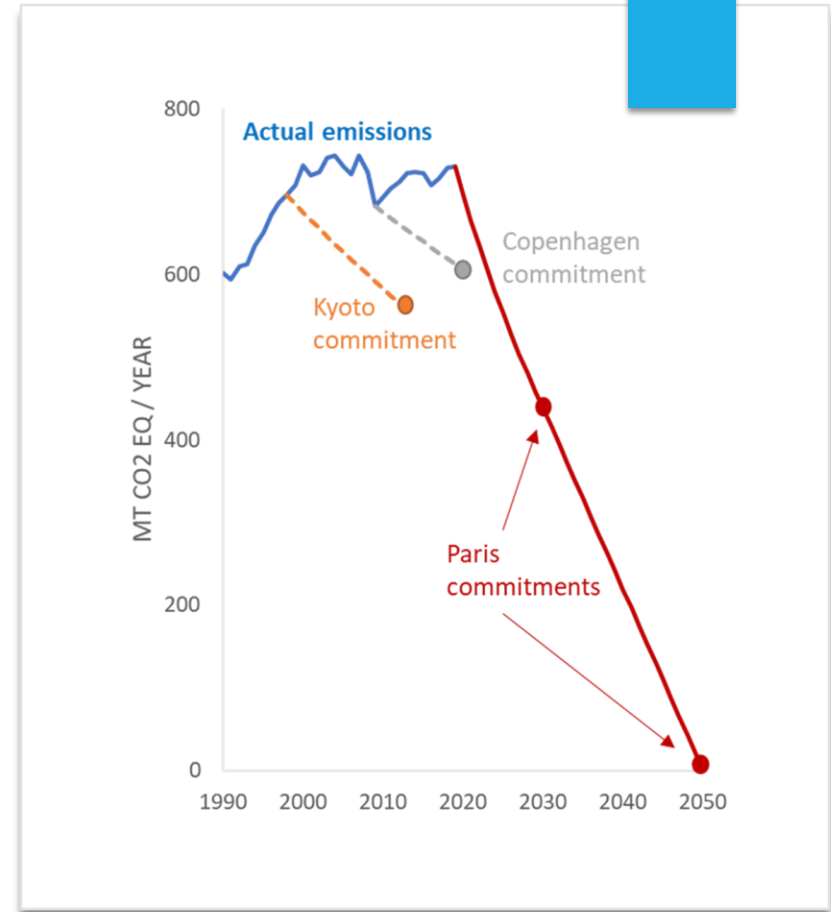
1. Kyoto
2. Copenhagen
3. None
4. All

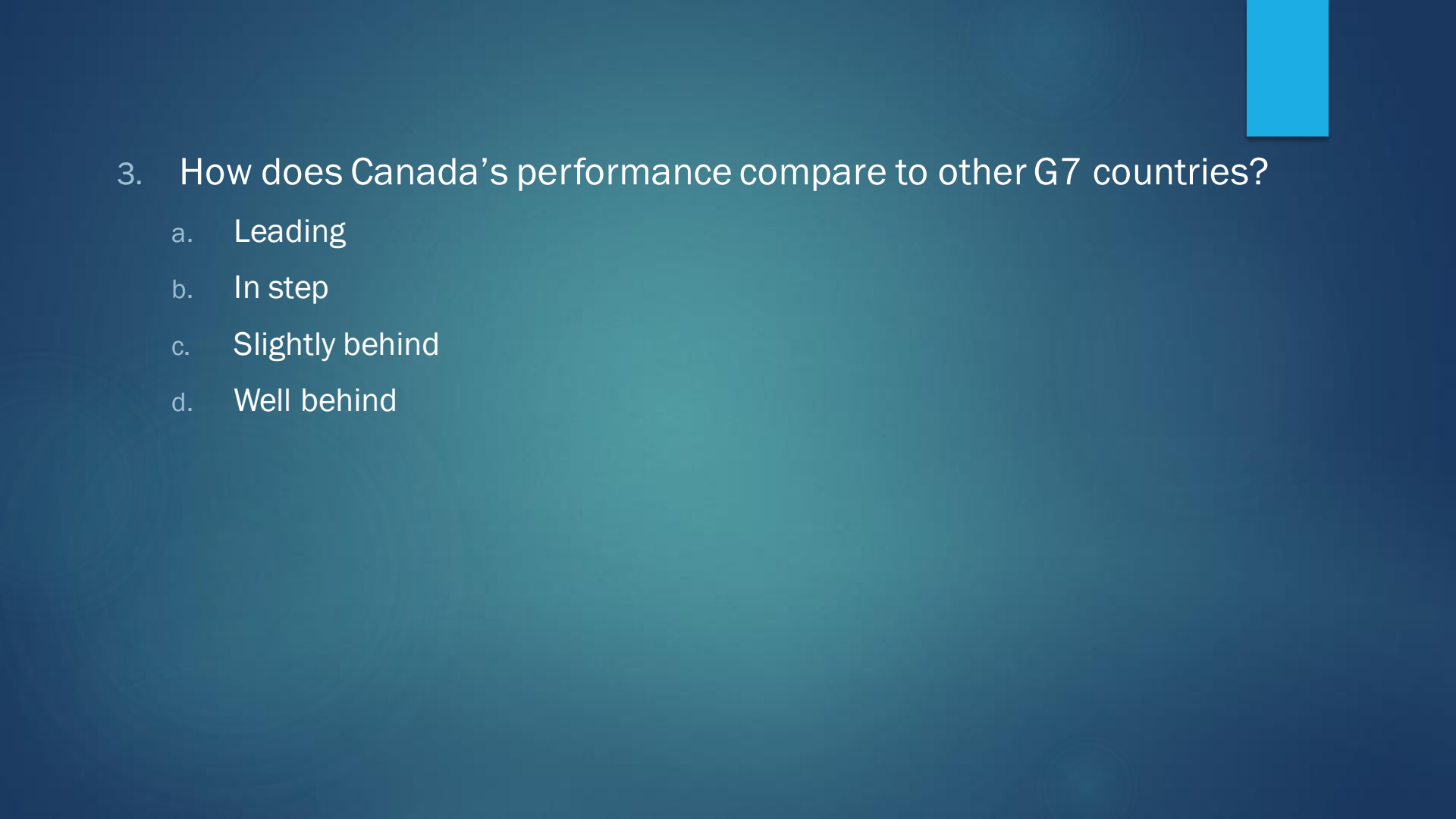
## Question 2

# Which climate targets has Canada met?

[C] Canada has not met any targets to date

- ▶ Kyoto commitment (1997): -6% of 1990 levels by 2008-2012
- ▶ Copenhagen commitment (2009): -17% of 2005 levels by 2020
- ▶ Paris revised NDC (2021): -40% to 45% of 2005 levels by 2030



- 
3. How does Canada's performance compare to other G7 countries?
    - a. Leading
    - b. In step
    - c. Slightly behind
    - d. Well behind

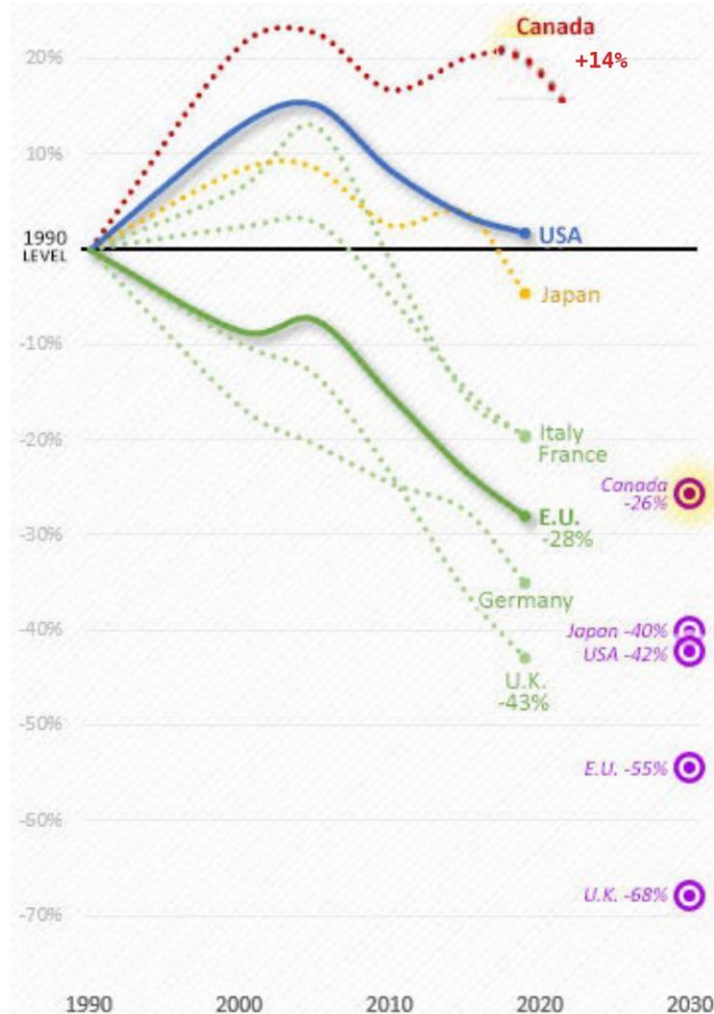


# Question 3

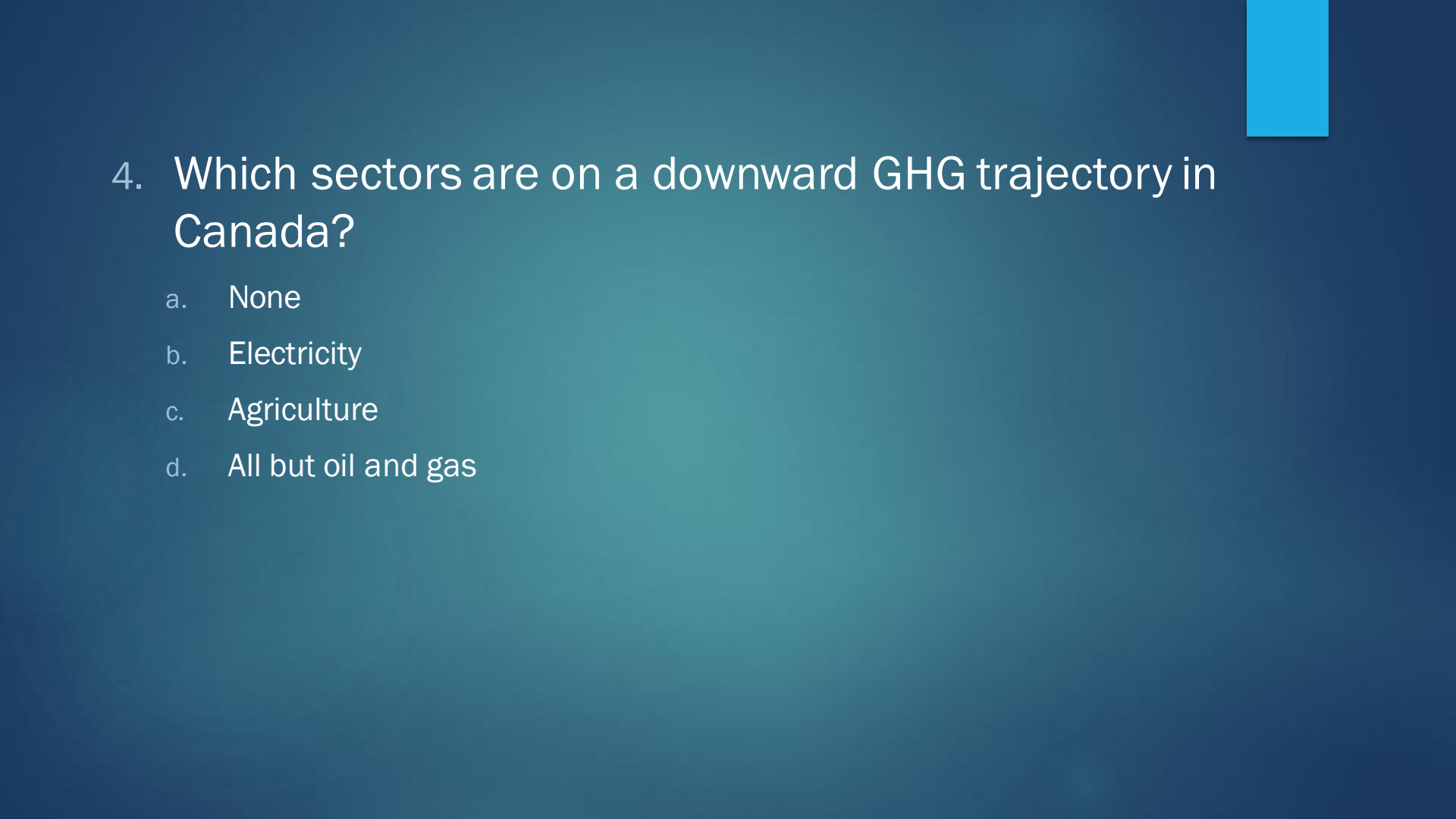
How does Canada's performance compare to other G7 countries?

[D] We are well behind all other G7 countries

- ▶ Most have reduced emissions substantially
- ▶ Even the USA is on a downward trajectory and nearing 1990 levels



Equivalent to -40 - -45% reductions compared to 2005 levels



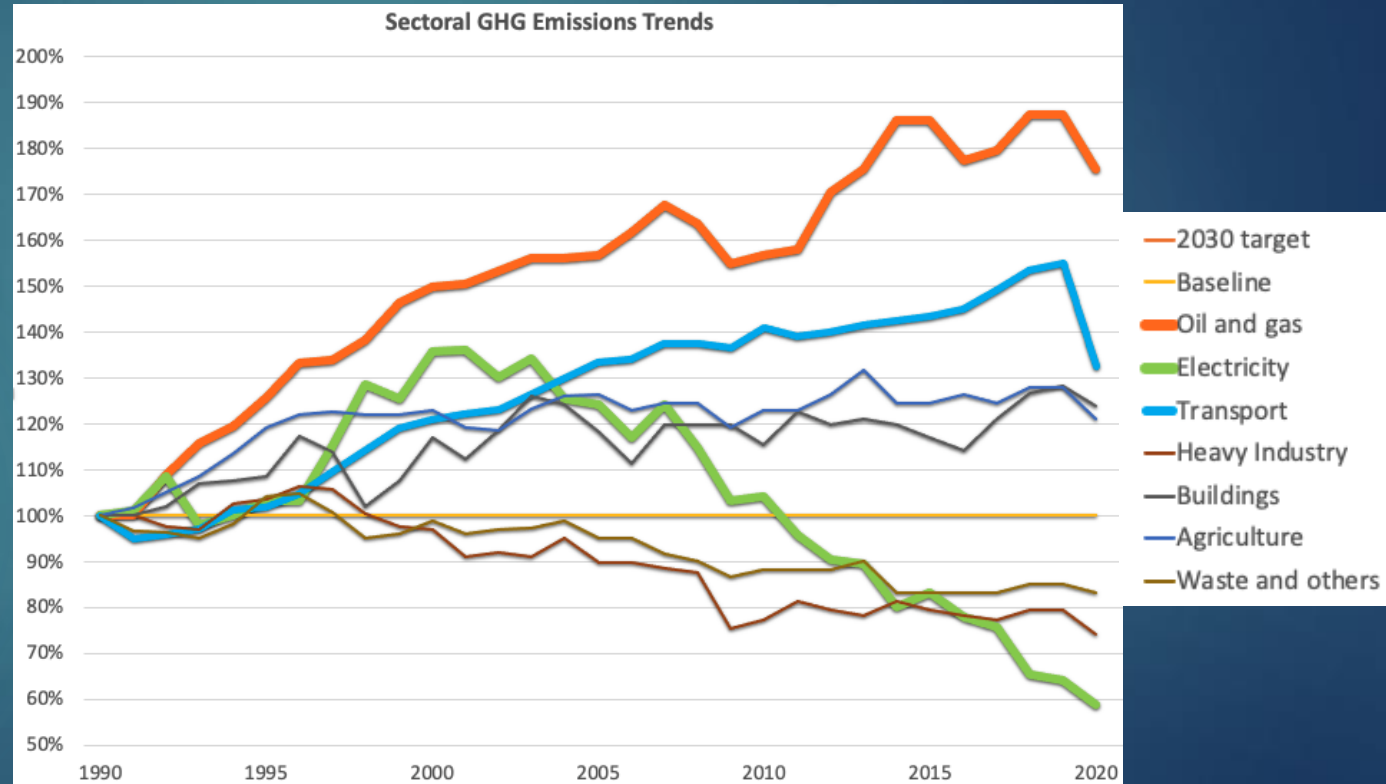
4. Which sectors are on a downward GHG trajectory in Canada?

- a. None
- b. Electricity
- c. Agriculture
- d. All but oil and gas

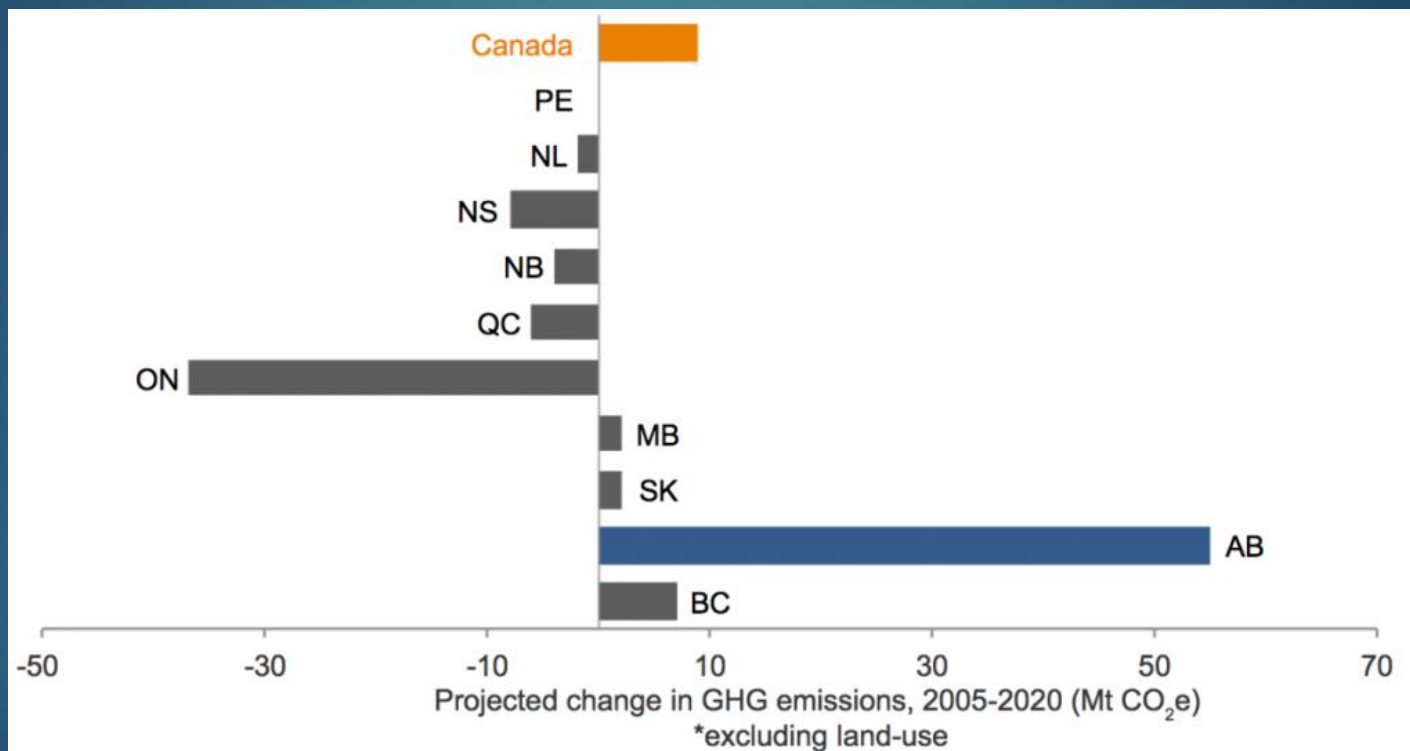
# Answer to question 4

[B] Electricity is on a downward trajectory

Oil & gas and transport display marked upward trends



# GHGs in Canada



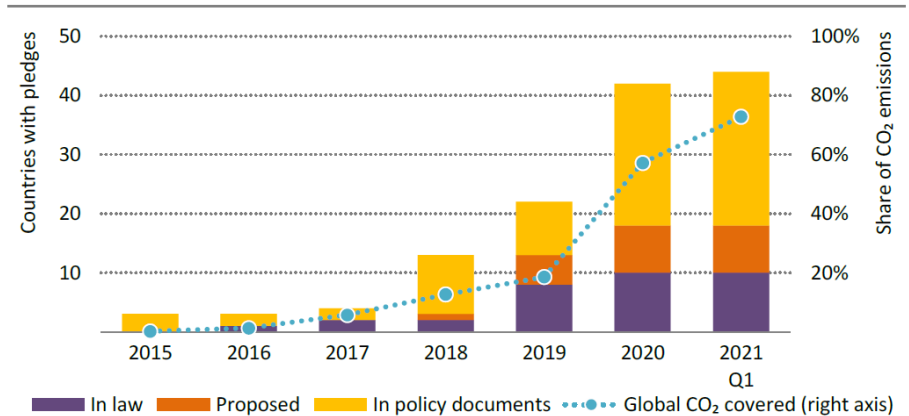
# Shutting down coal

29



The world's economies are increasingly moving to adopt net zero targets and strategies to get there

**Figure 1.2** ▶ Number of national net zero pledges and share of global CO<sub>2</sub> emissions covered



IEA. All rights reserved.

*There has been a significant acceleration in net-zero emissions pledges announced by governments, with an increasing number enshrined in law*

# Canada's net zero target

The Government of Canada has recently committed to reach net-zero emissions by 2050

Enshrined in the Canadian Net-Zero Emissions Accountability Act (royal ascent June 29, 2021)



# What do we mean by net zero?

“**Net-zero emissions** means that anthropogenic emissions of greenhouse gases into the atmosphere are balanced by anthropogenic removals of greenhouse gases from the atmosphere over a specified period” (The Act)

But removals present serious challenges.

So, it is about **getting as close to zero emissions as possible** by reducing or eliminating GHGs **in all sectors**



# The challenge of removals

‘Nature-based’ and technological solutions

All face serious challenges

Permanence

Uncertainty

Scale of deployment

High cost

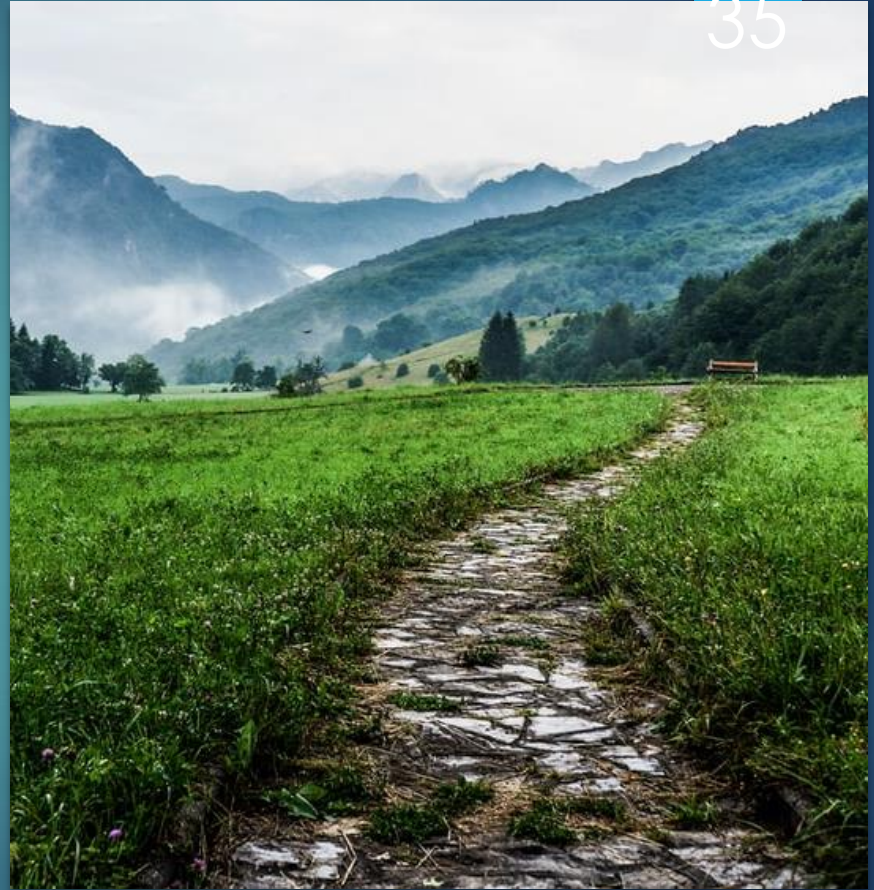


# So where does this leave us?

- ▶ The functioning of all sectors is deeply entwined with GHG emissions
- ▶ No silver bullets for mitigation or removal
- ▶ Reaching net-zero entails **fundamentally transforming** all sectors (from transport to agri-food) over two to three decades
  - ▶ Get as close to zero as possible
  - ▶ Offset the residual with removals

# Net Zero: Key Messages

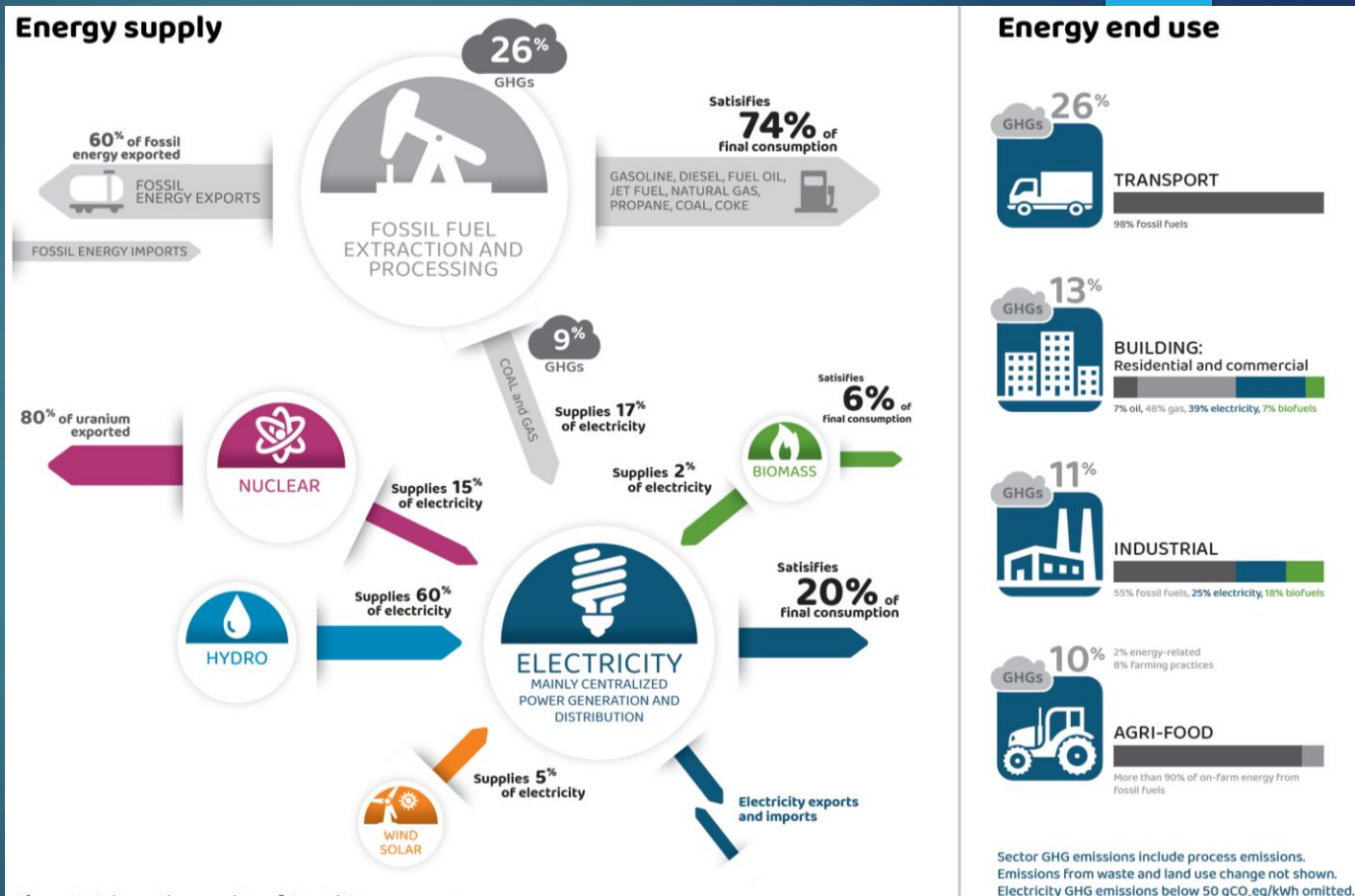
- ▶ An inclusive conversation
- ▶ Don't get "caught in the net"
- ▶ There is more certainty than uncertainty
- ▶ Global consensus is clear (ish)
- ▶ Take a transition pathways approach
- ▶ Move quickly on clear pathways (Investigate obstructed pathways)
- ▶ Agriculture is critical (vs forests...)



# The nature of the problem

Current energy system at the centre of the problem  
= ~80% of GHGs

Other GHGs: farming practices, industrial processes, waste, land use





Old energy  
systems

New energy  
systems

“**Net zero pathways** require spending a similar fraction of GDP that we spend on energy today, but we have to immediately shift investments toward new clean infrastructure instead of existing systems,” *Net-Zero America, Princeton University, 2021*.

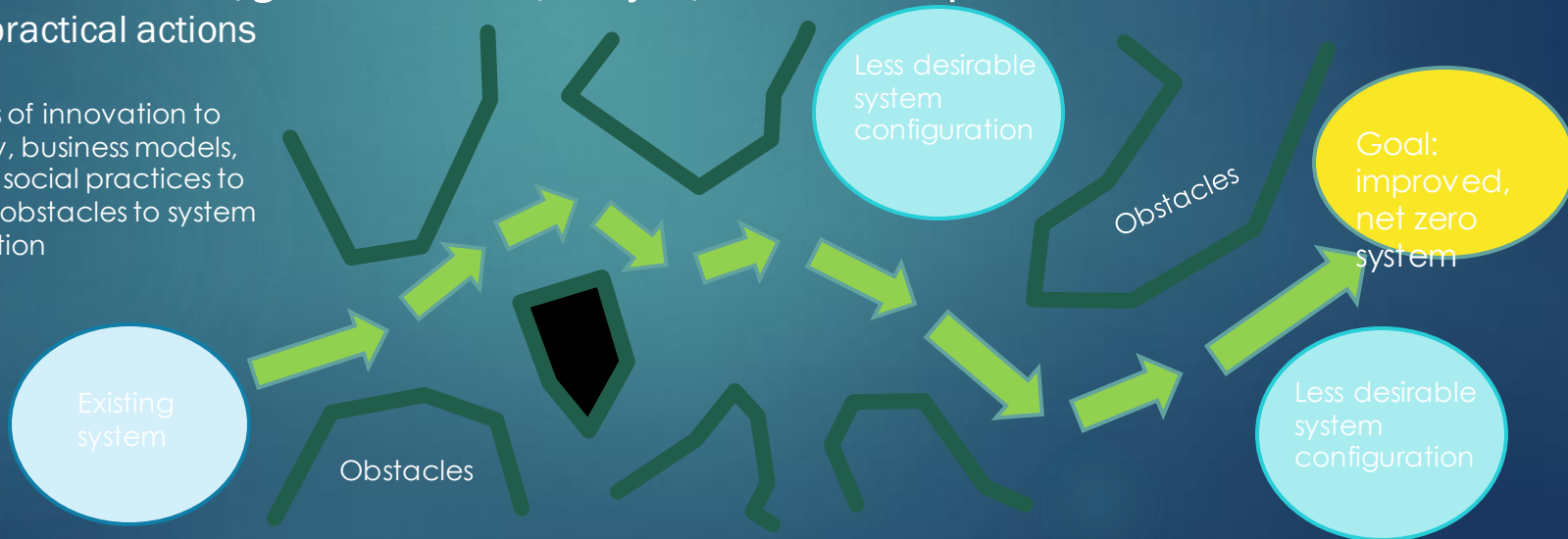
# Pathways are about getting from here to there . . .

They connect **where we are today** with a **desirable future system configuration** through sequences of steps that will be refined over time based on learning

They involve **multiple social and technological elements** required to transform a system to reach net zero

They include **narratives, grounded in data, analysis, and shared aspirations** that can be built out through practical actions

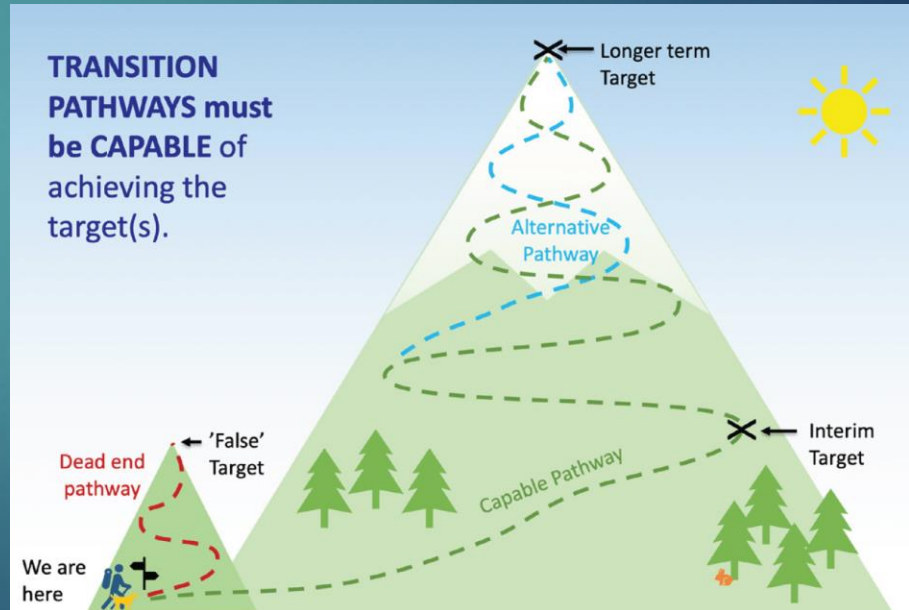
Sequences of innovation to technology, business models, regulation, social practices to overcome obstacles to system transformation



# ...and about what directions to avoid

They can help us avoid dead-end pathways that lock-in system components that will become emissions liabilities by mid-century

Example: Liquefied natural gas for heavy duty vehicles



# Pathways have broad relevance



For government, the private sector and civil society

Situate an organization's place in the broader system, identify strategic objectives to reach net zero, and identify change levers and priority actions

Can be applied at multiple scales (business, community, region)

Thinking in terms of pathways is not foreign – most organizations are already engaged in some form of strategic planning



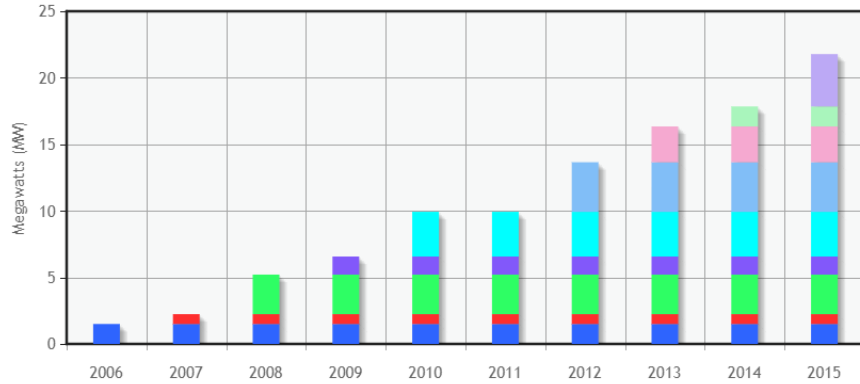
# Net zero pathways for wood pellets

- ▶ Net zero pathways challenging
- ▶ Northern and regional opportunities critical
- ▶ Identifying and overcoming barriers
  - ▶ European boilers
  - ▶ Access to residue
- ▶ Making the economic case
- ▶ Support for upfront capital

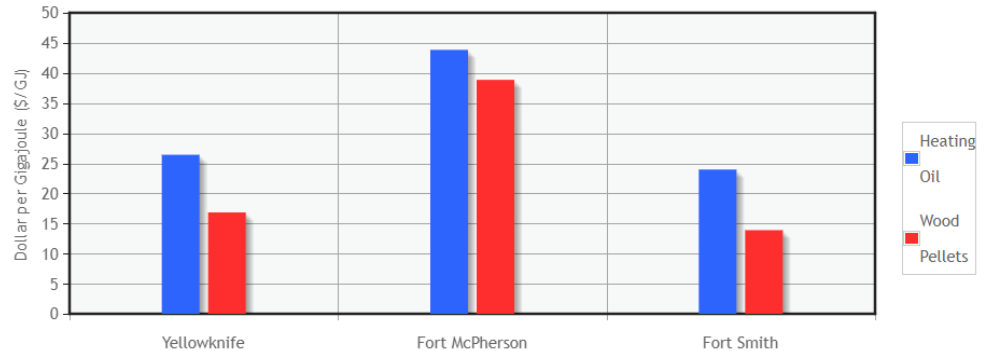


# Northern and remote opportunities

Wood-Pellet Boiler Capacity in the NWT Organized by Annual Vintages



Price of Heating Oil vs. Price of Wood Pellets in three NWT Communities as of June 2015



North

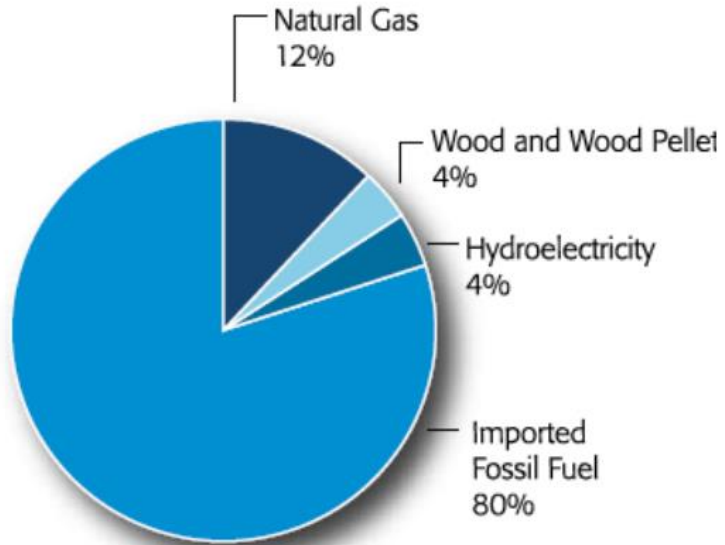
2022

## **Public problem, private solution: Warehouse biomass project reduces N.W.T. carbon footprint**

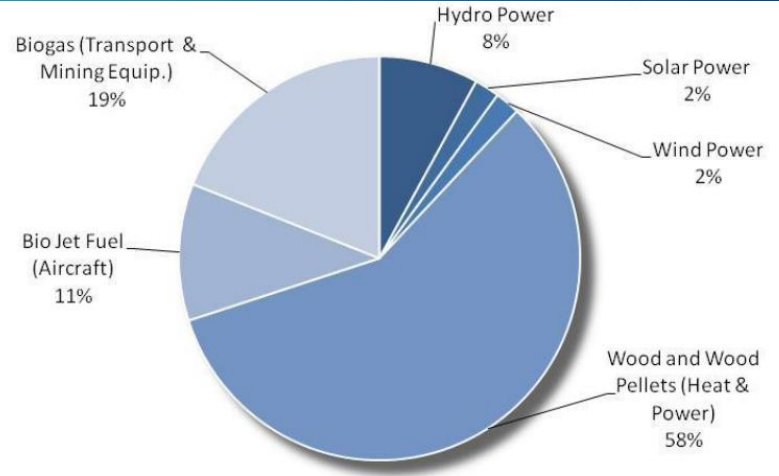
**A wood pellet heating system that warms four buildings in Yellowknife has, after a year of operation, helped its biggest client — the territorial government — cut oil-use by 92 per cent.**



### 2012 - Energy Mix - NWT



### 2050 - Net-Zero Energy Mix - NWT



When we talk about solving  
climate change...

The image features a dramatic sunset sky with warm orange and yellow tones and scattered clouds. In the foreground, the silhouettes of a bear and a bull are perched on a dark, rocky outcrop. The bear is on the left, looking towards the right. The bull is on the right, rearing up on its hind legs, facing the bear. The overall scene is a metaphorical representation of the conflict between environmental concerns and economic growth.

What we're really talking about is a great  
global economic and social transition...



...one which involves confronting serious economic and human risk.

In 2021, disasters triggered by weather-and climate-related hazards cost the world **US\$280 billion.** (Source: Eco-Business, 2022)



...while grasping  
unprecedented economic  
opportunity.

***“We are on the cusp of a new  
economic era”***

The world is expected to invest  
about **US\$90 trillion** on  
infrastructure in the period up to  
2030.



Solving climate change will enable the “*great transition*” by helping us transform how we grow food, generate and use energy, build cities, move people and goods...



# Key takeaways



## Don't get caught in the “net”

Successful approaches drive emissions as close to zero as possible

## Target systems, not just prices or markets

Winning approaches appreciate that core societal systems (transport, electricity, agri-food) will need to fundamentally change to reach net zero

## Define where you want to go

Successful approaches involve identifying a desired end state and a clear sequence of steps to get there

## Emphasize societal improvements, not only emissions reduction

Successful approaches mobilize actors and resources by envisioning future systems that are not only net zero but also more prosperous, convenient, healthy, and equitable

# Key takeaways

## Act strategically to build pathways

Not everything is equally important. Work with change agents. Prioritize places where systems are in movement and change really counts. Don't try to do a little of everything

## Beware of dead-end pathways

Actions should build momentum on a pathway that can achieve overall goals

## Manage uncertainties, don't be paralyzed by them

We know a lot about how to get to net zero: only by doing can we learn more

## Adapt and deepen action

Successful approaches continually refine and adapt based on analysis, learning-by-doing, evolving system conditions, and the advancement of technologies and practices

Thank you

Questions?

