

Decarbonisation of road network

Role and importance of carbon

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TC 4.5 Decarbonisation of Road Construction and Road Maintenance - WG Leader

PIARC UK Event

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Decarbonisation Drivers

- *Reduction or elimination of carbon dioxide emissions from a process such as manufacturing or the production of energy.*
- **Global Challenge:** Transportation accounts for approximately 20-25% of global CO_2 emissions
- **Role of Highways:** Road transport with personal and freight vehicles are the largest sources.

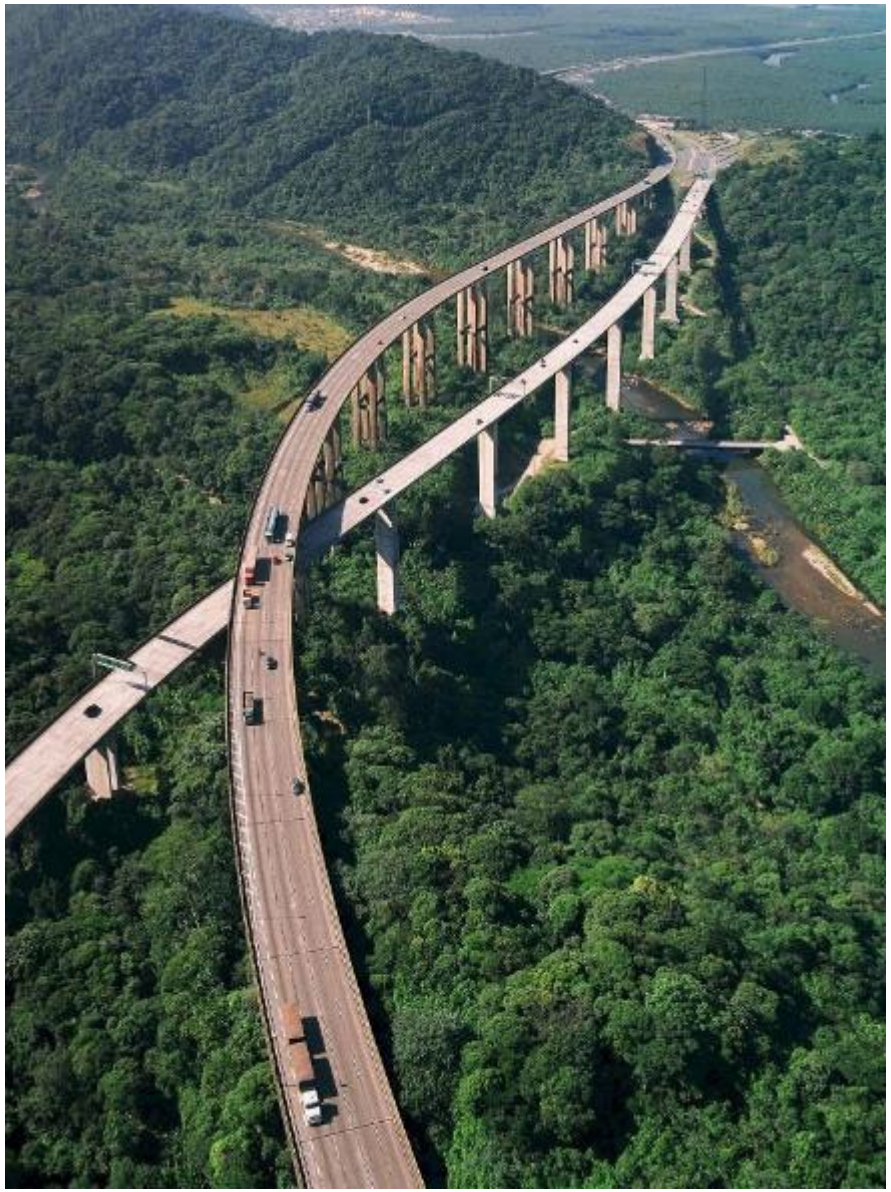
- **Drivers**

Climate Change Mitigation
100% reduction by 2050 – 'net zero'

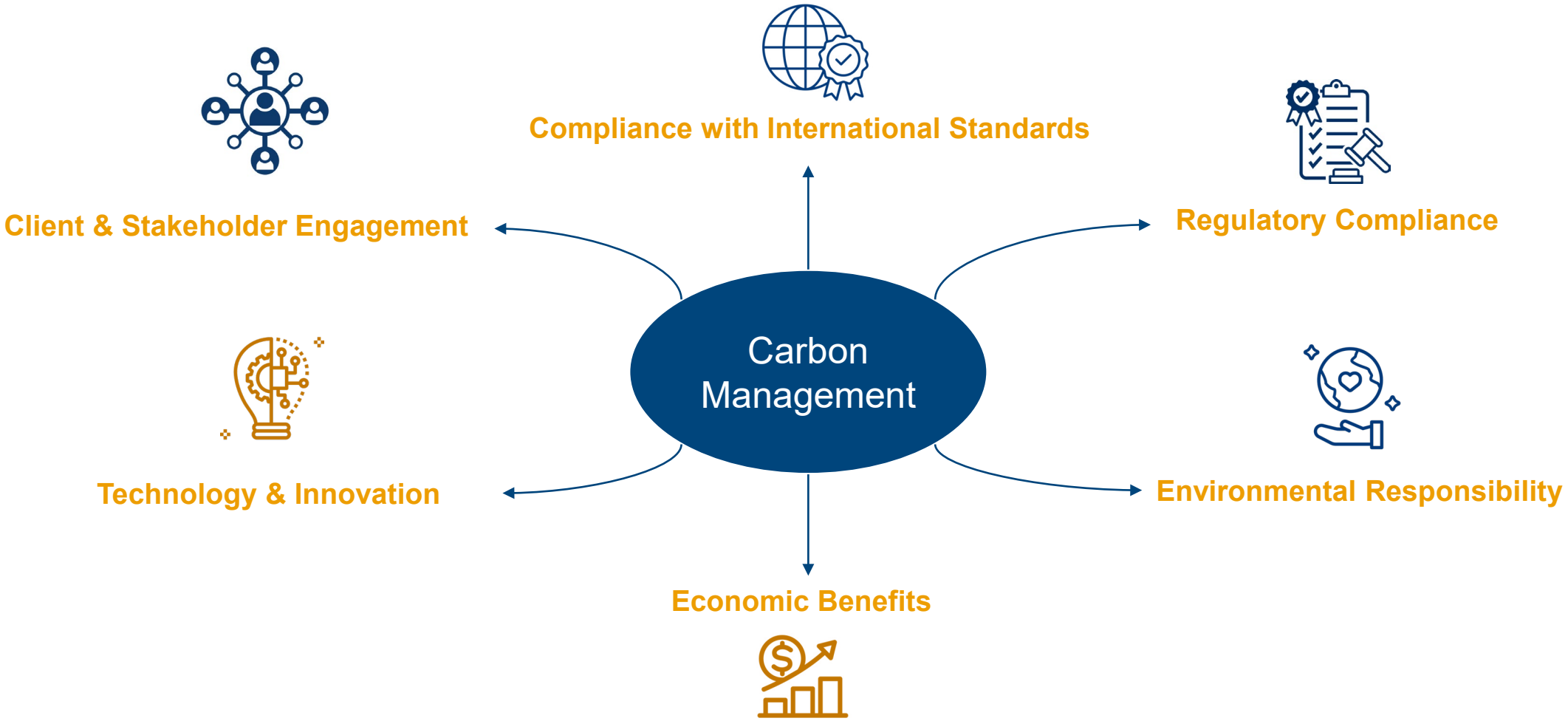
Energy Transition
From fossil fuels to renewable

Air Quality Improvement
Reduction of pollutants like Nox & Particulate Matter (PM2.5)

Public Health
Improved public health and reduce healthcare costs



Carbon Management and its Importance



Main Sources of Carbon Emissions on Highways

Vehicle Emissions

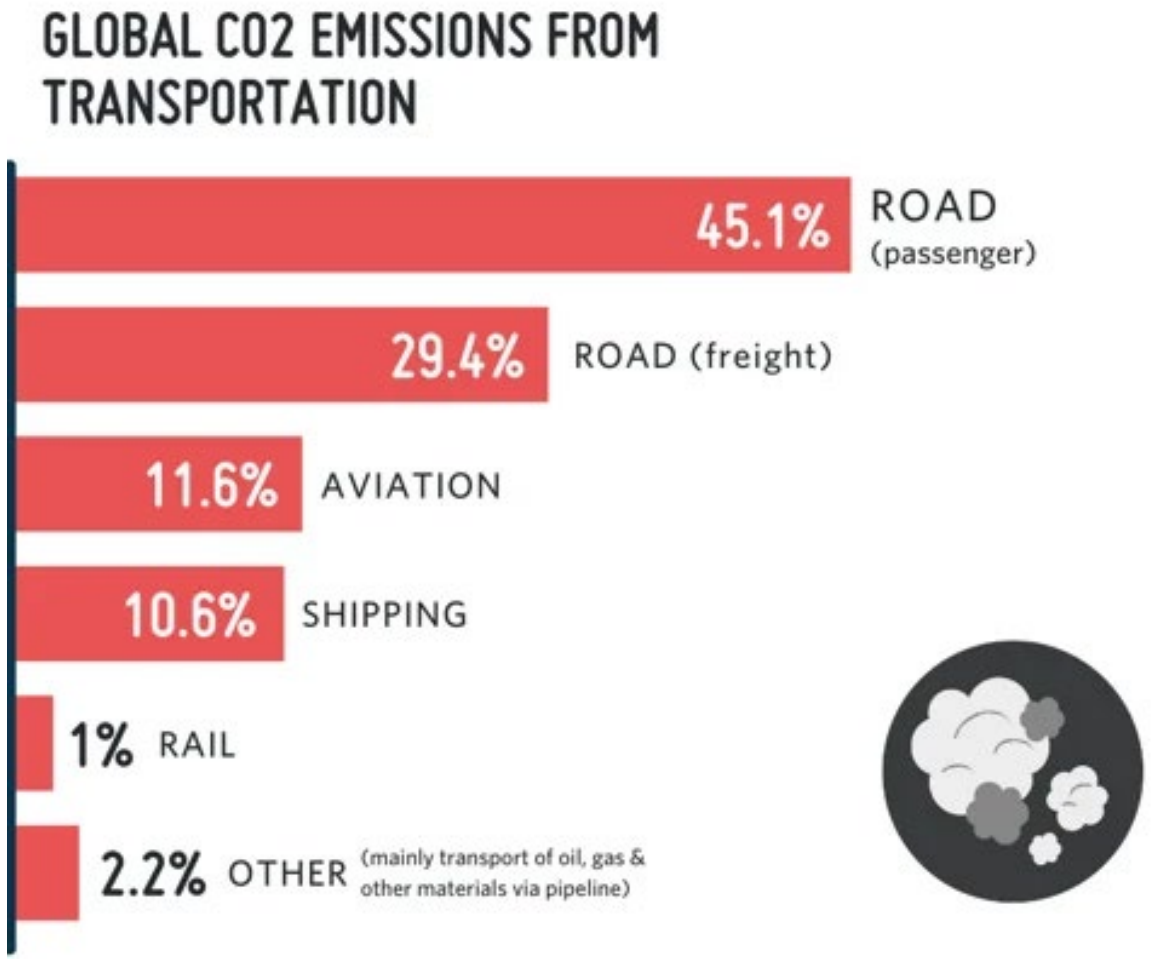
- Gasoline and diesel engines in passenger vehicles
- Freight transport with heavy-duty trucks

Highway Construction and Maintenance

- CO_2 generated from materials like asphalt, concrete, steel, etc.
- Energy used in construction equipment and processes.

Traffic Congestion

- Increased emissions from idling vehicles and stop-start traffic patterns.



Source: Our World in Data based on International Energy Agency & International Council on Clean Transportation

Key Pillars for Decarbonisation

GOVERNANCE

STRATEGIC VISION

POLICY AND REGULATIONS

ASSET MANAGEMENT SYSTEMS

OPERATIONAL PRESERVATION

INFRASTRUCTURE DESIGN AND MAINTENANCE

CONSTRUCTION PRACTICES

OPERATIONAL EFFICIENCY

RENEWABLE ENERGY INTEGRATIONS

RECYCLE/END OF LIFE

Highway Construction & Maintenance – Carbon measurement opportunities

GOVERNANCE

- Councillors
- Liverpool City Council Leadership
- Improvement Plans
- Promote sustainability target(s) within Cllrs Jurisdictions to reduce **Carbon** emissions
- Funding

STRATEGIC VISION

- Sustainable, efficient, and inclusive transport network that supports the city's economic growth, improves quality of life, and reduces environmental impact
- Reduce **Carbon** (Where/How/When)
- Infrastructure Improvement
- Integration with Public Transport
- Community and Stakeholder Engagement
- Innovation and Technology
- Strategic Decision making
- Regulatory Compliance

POLICY AND REGULATIONS

- 2030 Net Zero Liverpool Action plan
- Renewables
- Clean air
- Active Travel
- Waste/recycling Management
- **Carbon** reduction policy
- Regulatory Compliance

OPERATIONAL PRESERVATION

- Asset Utilisation
- Efficient Management
- Reduce need for new construction
- Materials and resources conservation
- Reduced congestion
- Innovative techniques
- Adopt green technologies
- Structural, Functional, Safety, User
- **Monitor Carbon**

ASSET MANAGEMENT SYSTEMS

- Asset Data collection and Integration. Evaluate and identify gaps
- Lifecycle and Financial Planning. Smart Data, data strategy, data accuracy
- Highway Service and Programming
- Communications
- Performance Management
- Risk Management
- **Carbon** Management
- Predictive Maintenance

INFRASTRUCTURE DESIGN AND MAINTENANCE

- Ranking and Prioritisation.
- Decision Making and Register
- Network needs
- Programme/Optioneering
- Calculate Whole life Cost/**Whole life Carbon**

CONSTRUCTION PRACTICES

- **Materials**
- **Innovation**
- Risk
- **Carbon Measurement**
- Communication
- Disruption/Delay time

OPERATIONAL EFFICIENCY

- Frequency
- Highway Lifecycle interventions short/long-term balance
- **Carbon outputs**
- Environmental/Climate Impact
- Preservation

RENEWABLE ENERGY INTEGRATIONS

- Encourage the use of renewable energy
- Monitor
- New Technologies
- Data analytics
- **Carbon** reduction measures

RECYCLE/END OF LIFE

- Reuse
- Recycling
- Circular Economy
- Measure **Carbon** Saving/output
- Future ready

Carbon impact of disasters

Carbon impact of natural disasters

- **Damage to Infrastructure:**
  - Road and bridge repairs
  - Energy from pumping out flood waters
  - Construction equipment
  - Debris removal
- **Traffic Disruptions and Detours:**
  - Increased travel distances
  - Congestion
- **Increased Transportation of Goods:**
  - Supply chain disruptions
- **Emergency Response:**
  - Rescue and relief efforts
  - Temporary facilities
- **Long-Term Shifts in Transportation Patterns:**
  - Reconstruction and expansion
  - Futureproof & Floodproofing infrastructure
- **Indirect Impacts:**
  - Agriculture and industry disruption
  - Vehicle damage and replacement

Asset Management & Carbon

- **Materials production**
  - Construction – Is it really required?!
  - Operation and Maintenance
  - End-of-Life
- **Low-Carbon Material Selection**
  - Alternative Binders
  - Recycled Materials
  - Warm-mix Asphalt
- **Sustainable Design and Planning**
  - Pavement Designs
  - Optimising Routes
  - Resilient Designs
- **Energy-Efficient Construction Practices**
  - Electric or Hybrid Equipment
  - Fuel Efficient Logistics
  - Lean Construction Techniques
- **Asset Maintenance and Rehabilitation**
  - Predictive Maintenance
  - Preventive Maintenance
  - Green Pavement Technologies
- **Sustainable Road Management Technologies**
  - Digital Twins
  - Smart Transportation Systems
- **Carbon Reporting and Compliance**
- **Stakeholder Engagement and Collaboration**

Challenges to Decarbonisation

Technical /Technological Barriers:

- Lack of expertise within this space
- Insufficient data to carry out necessary assessments
- Lack of verification of that data

Economic - High Initial Costs:

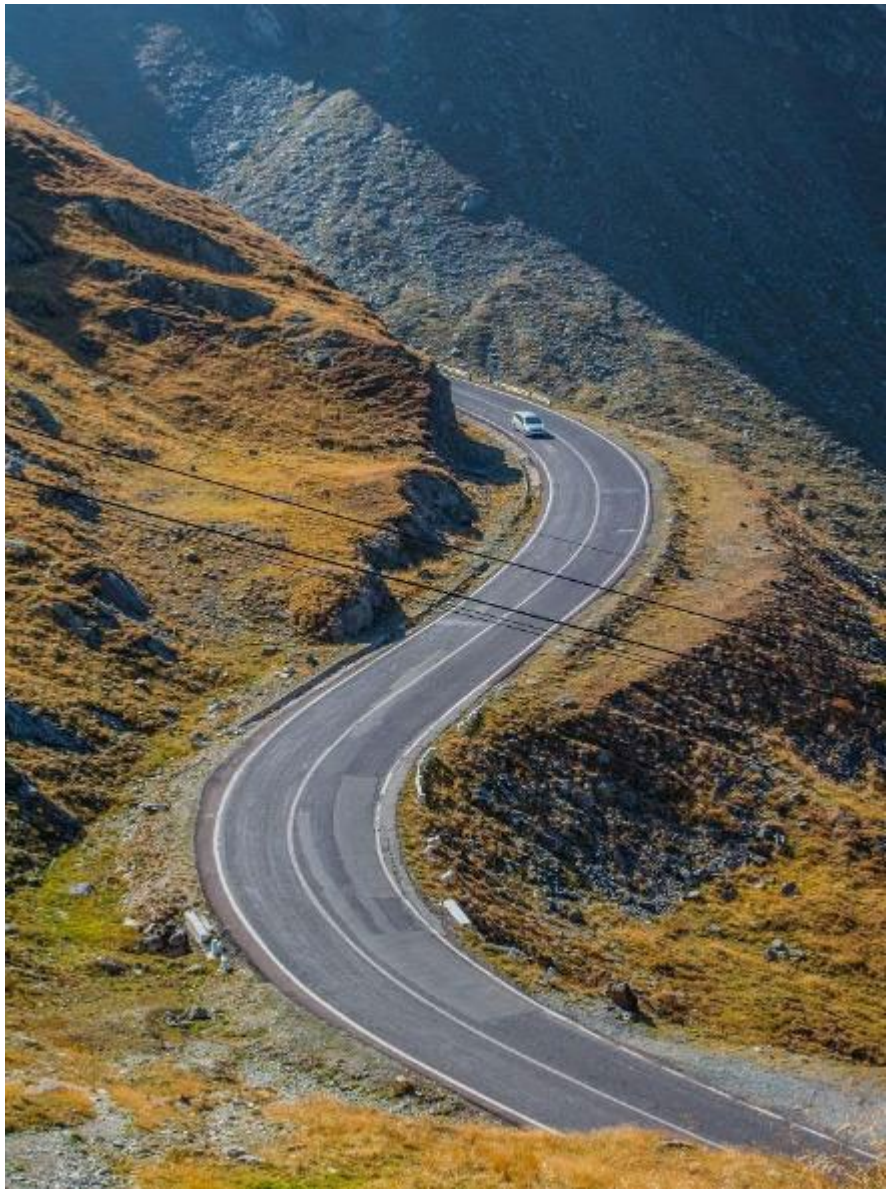
- Significant investment required for new infrastructure & green construction materials

Financial

- Lack of funding from central governments

Social - Policy Gaps

- Need for consistent policies and regulations across regions to drive Decarbonisation efforts
- Impact to community



Outlook and Recommendations

Continued Innovation

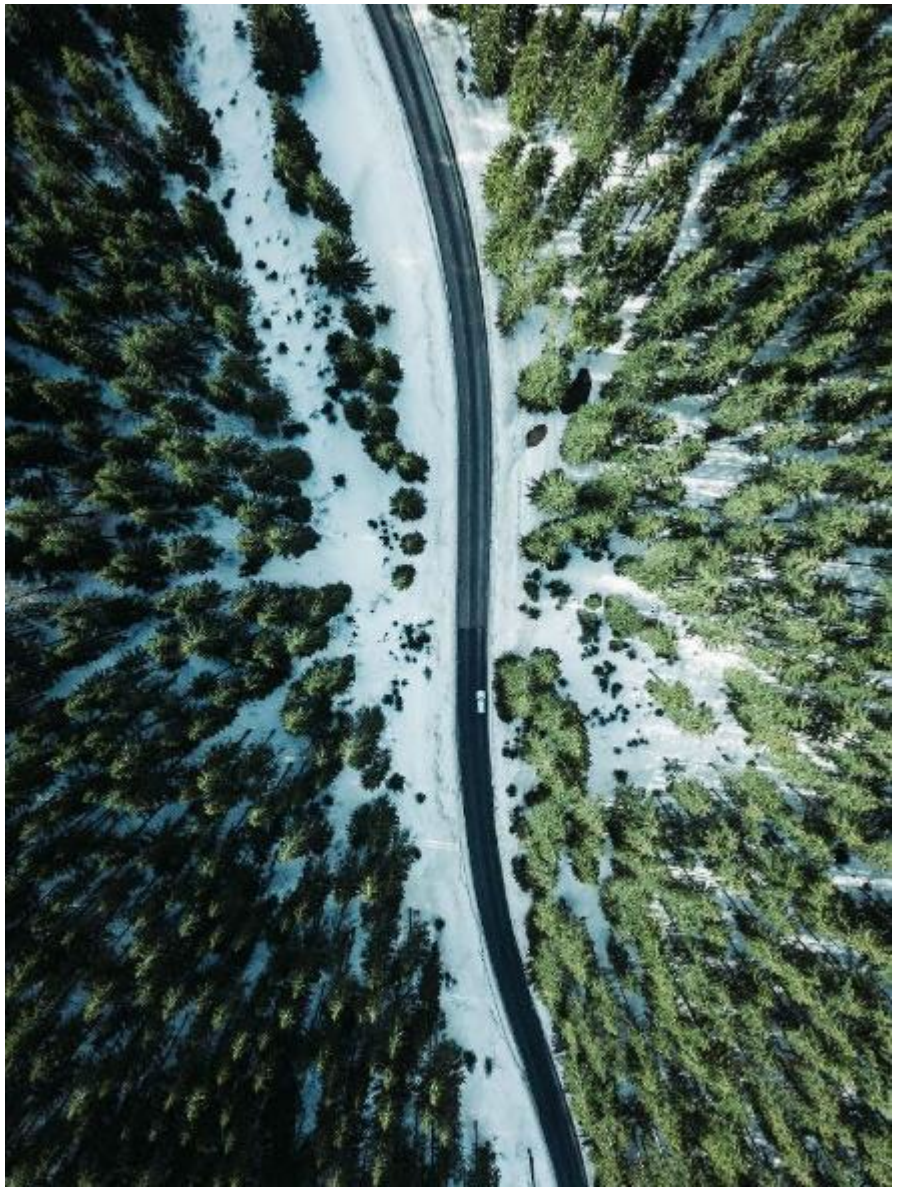
- Invest in research and development of cleaner technologies and materials

Collaboration

- Foster partnerships between governments, businesses, and civil society

Scalable Solutions

- Focus on scalable pilot projects to showcase viability before larger rollouts



Thank you!

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