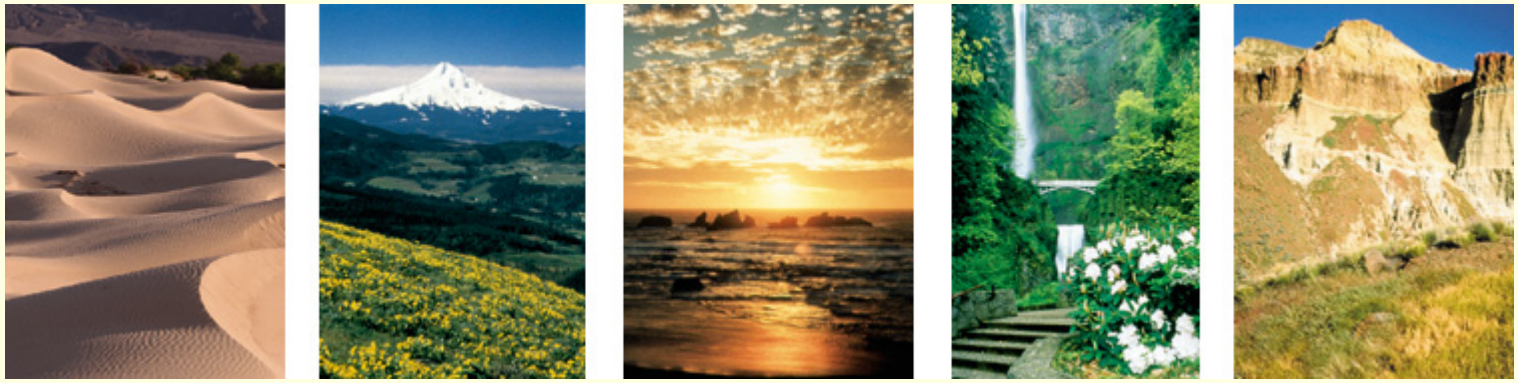


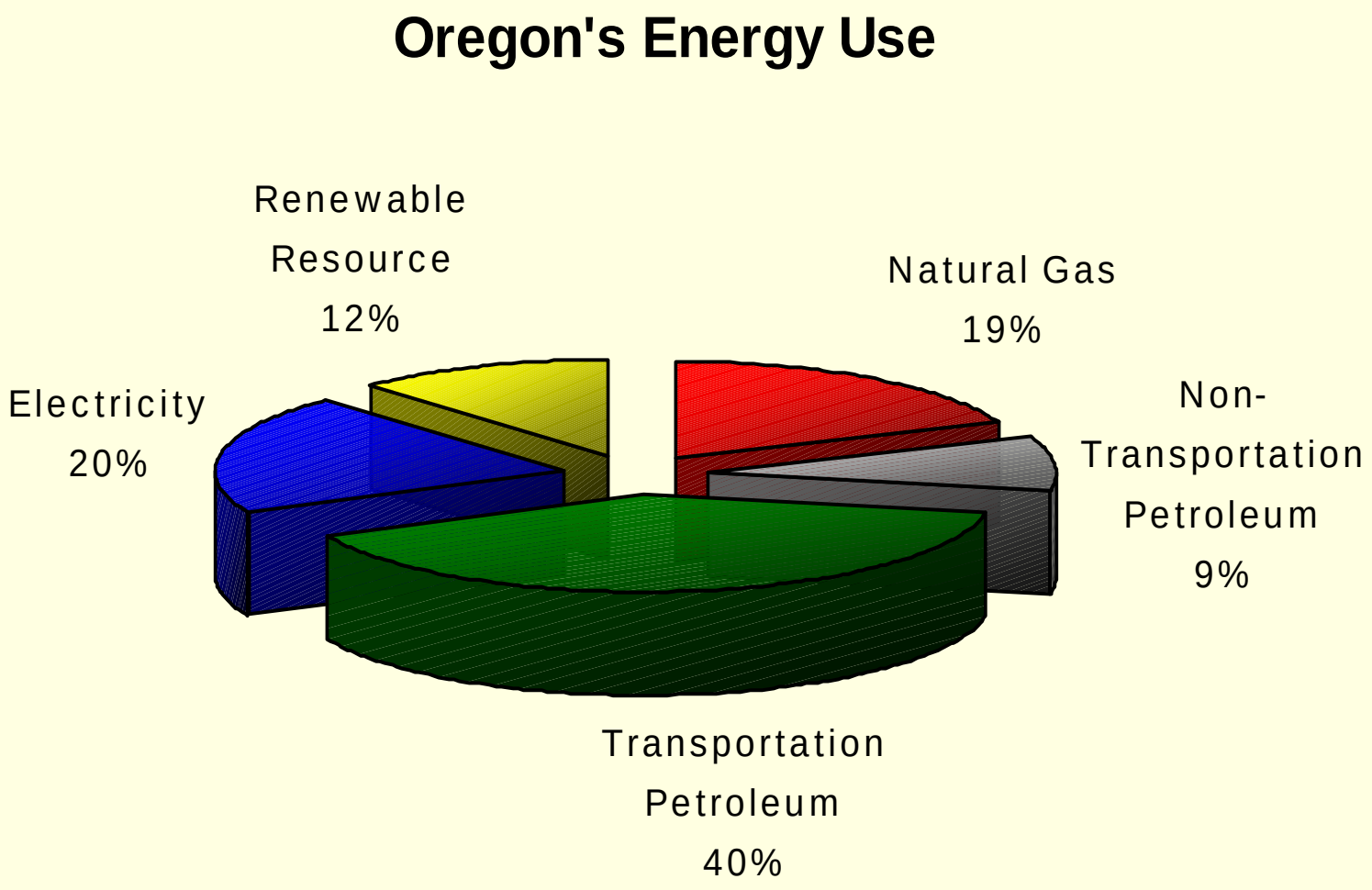
Hydrogen Fuel Development: Oregon's Perspective

Justin Klure
Oregon Department of Energy

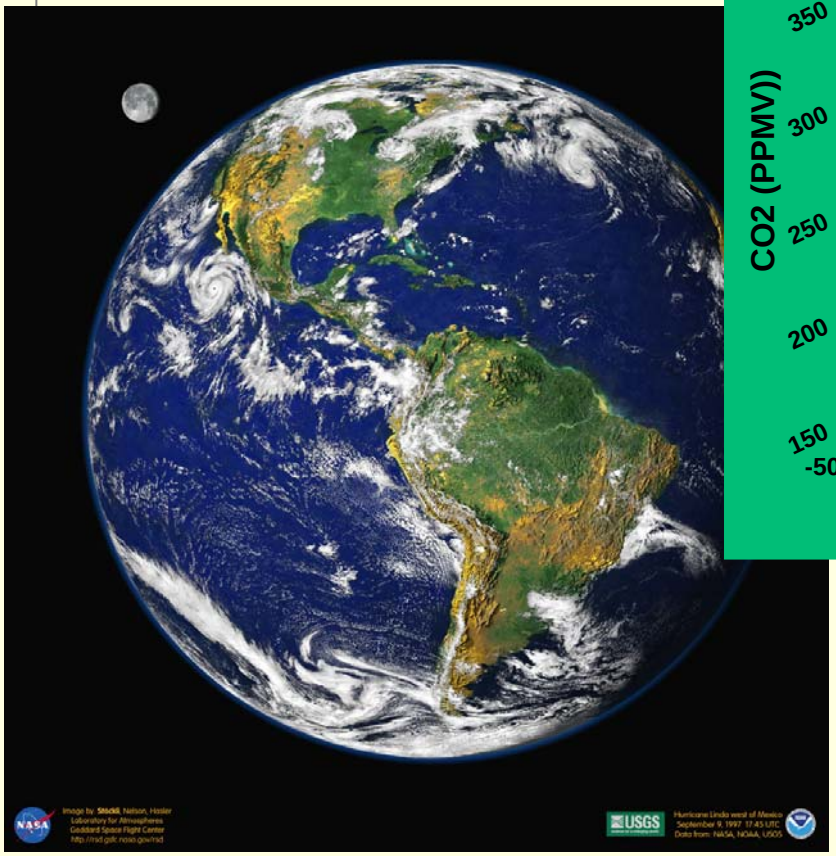
Department of Energy's Mission

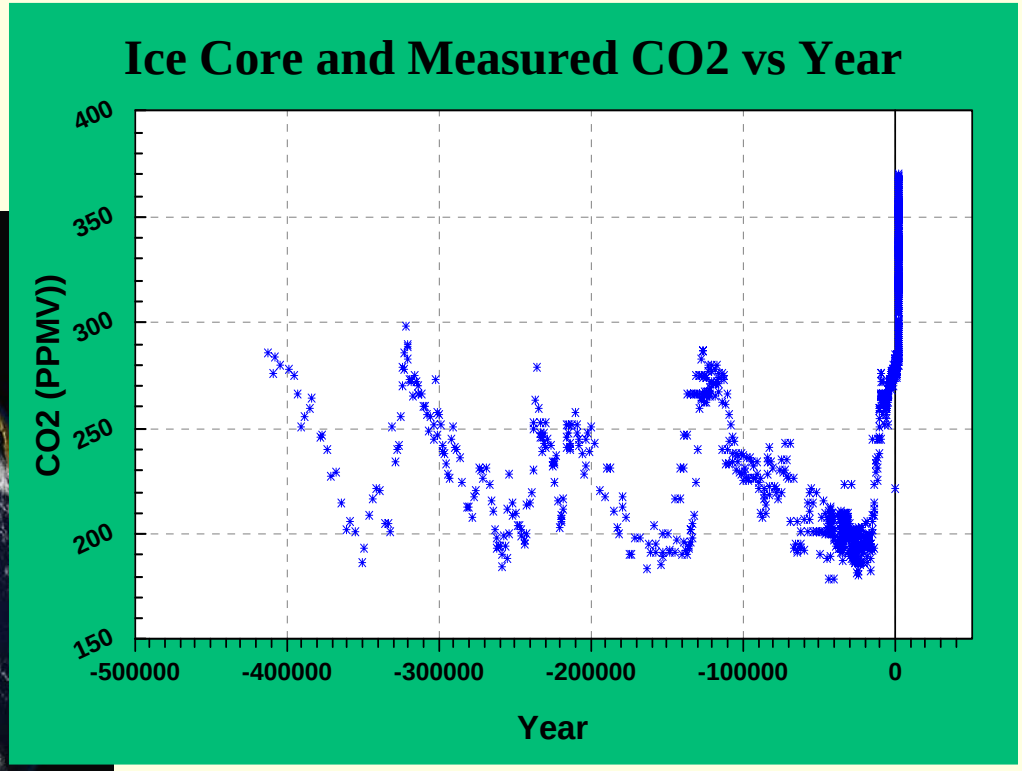
protect Oregon's environment by saving energy, developing clean new energy resources and cleaning up nuclear waste.

Oregon’s Energy Use



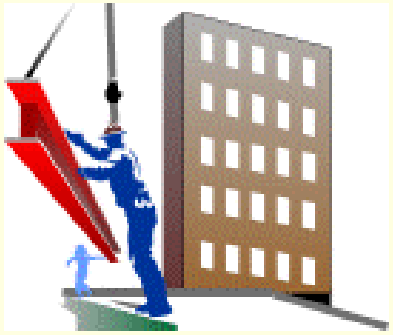
The Case for Hydrogen





The Case for Hydrogen

JOBS



ECONOMY

ENVIRONMENT

Sources of Hydrogen

Biomass

Natural Gas

Water

Coal

Methanol

Gasoline

The Reforming Process

Steam

Electrolysis

Thermochemical

Photoelctrochemical

Biological

Gasification

Hydrogen Facts

- Hydrogen is NOT an Energy Source
- Makes up 75% of Known Universe
- Must be Reformed To be Used
- Hydrogen Cannot Clean the Air

Myths About Hydrogen

- An entire hydrogen industry would need to be developed from scratch
- Hydrogen is too dangerous and explosive
- Making hydrogen uses more energy than it yields, so it's prohibitively inefficient
- A viable hydrogen transition would take 30-50 years or more to complete, and hardly anything could be done sooner than 20 years

The Hydrogen Economy

Production

Delivery

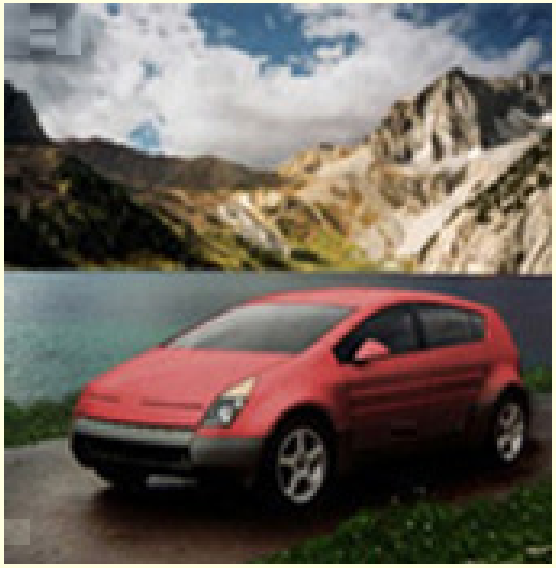
Storage

Conversion

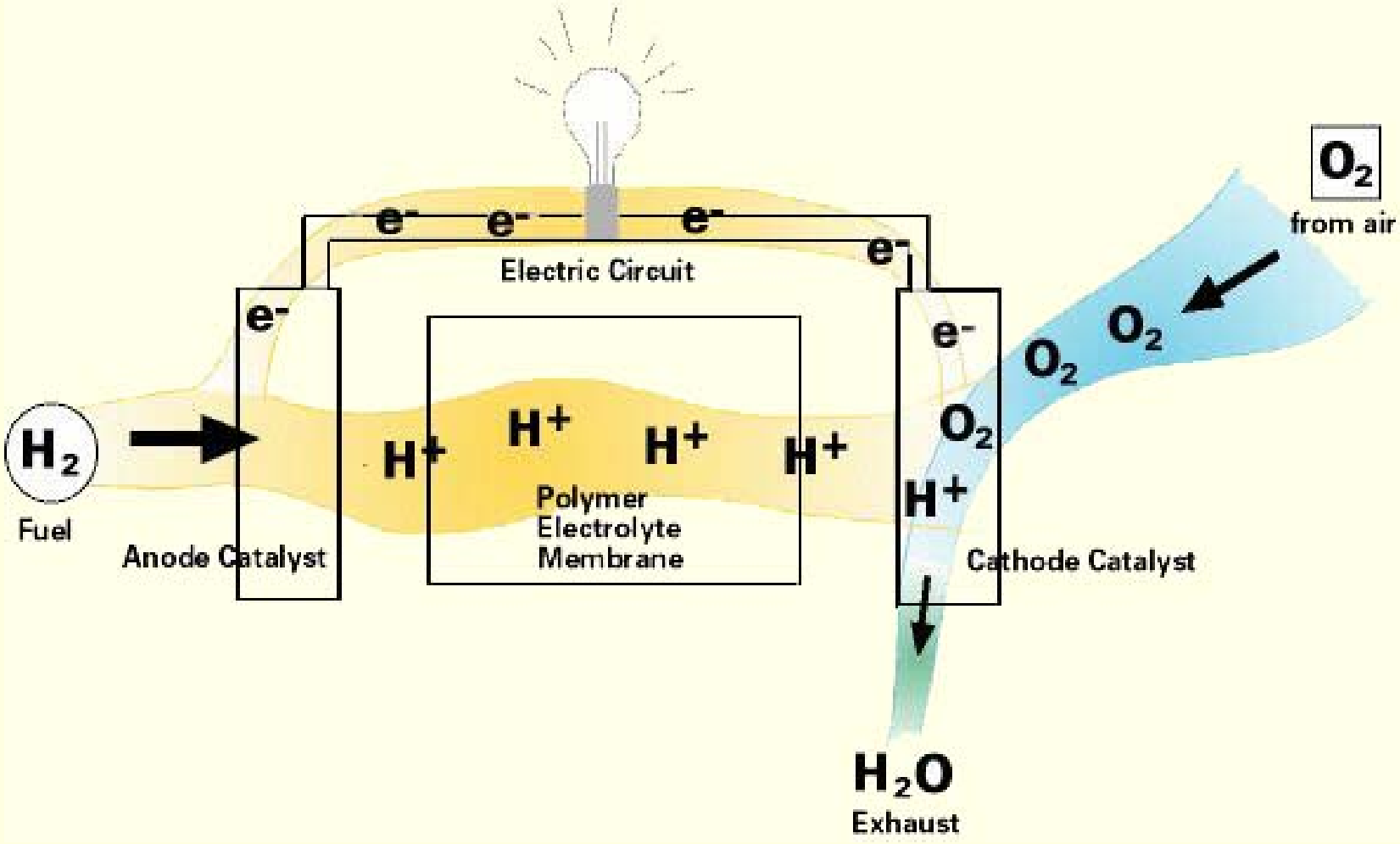
Applications

Advantages of Hydrogen

- Non-polluting
- Economically Competitive
- Safer than gasoline, diesel, or natural gas
- Hydrogen can establish create energy security
- Distributed generation



The Fuel Cell



Demonstration Studies

Las Vegas

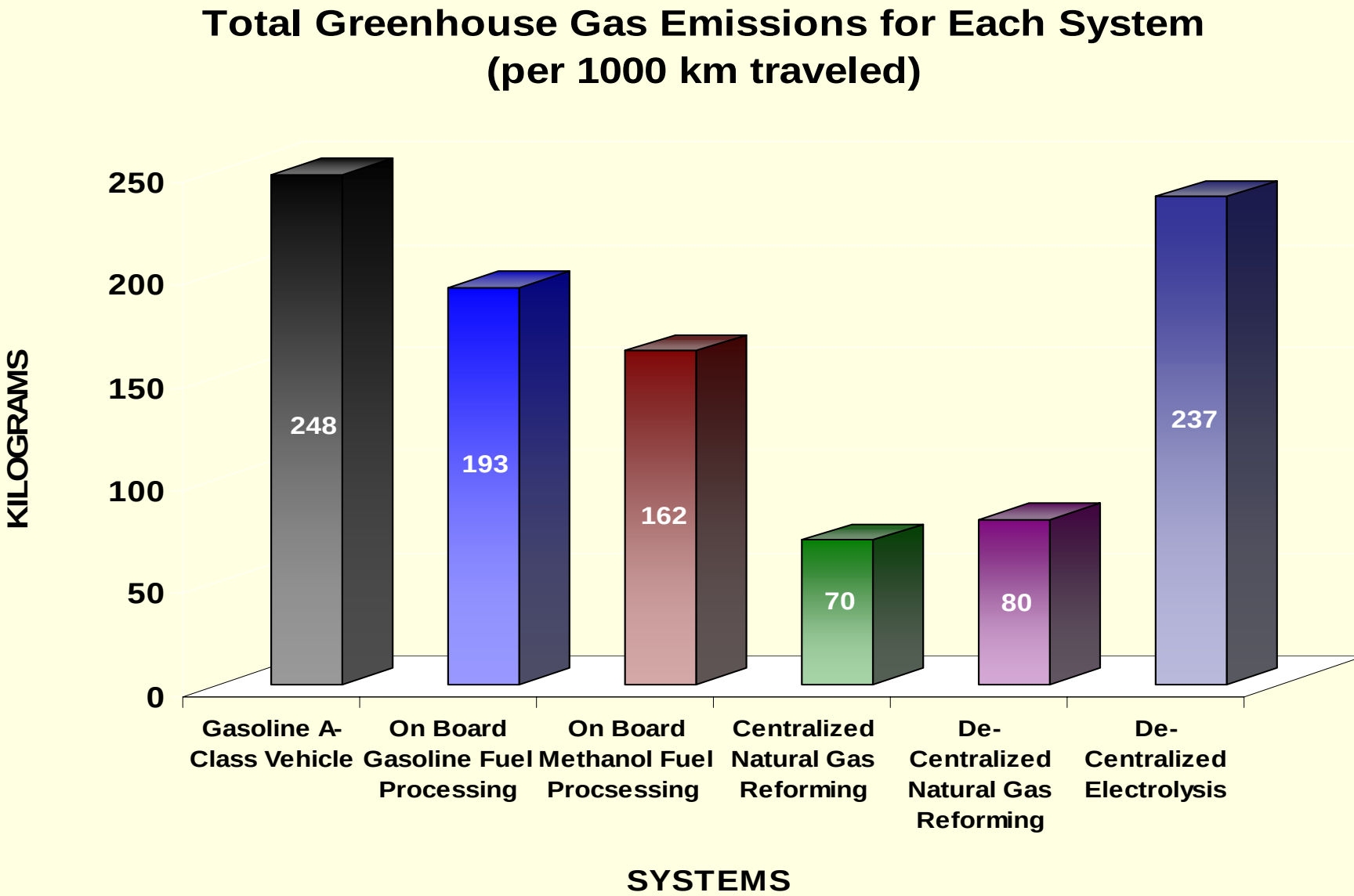
Sunline Transit

California FCP

BPA

NW Hydrogen Project

Emissions - Vehicle Study



Technical Barriers

- Costs
- Weight and Volume
- Storage
- Distribution
- Refueling Time
- Codes and Standards
- Life-Cycle and Efficiency Analysis

Oregon's Role and Priorities

- Renewable - based Hydrogen Economy
- Institutional Framework
- Efficiency standards for Fuel Cells

<u>Hydrogen for Transportation</u>

- Adopt GHG emission standards for vehicles
- Increase blending of biofuels
- Reduce vehicle miles traveled

Infrastructure Development

- Preferred Hydrogen Production Methods
  - Electrolysis using electricity from renewable resources
  - Reformation of biomass resources

- Fuel Cell Development
  - Reformers, inverters, etc.

- Demonstration Projects
  - Columbia Wastewater Treatment Center

Partnerships and Related Activities

- USDOE's Hydrogen, Fuel Cells, and Infrastructure Technology
- Oregon Renewable Energy Action Plan

<u>Other Efforts</u>

- Hydrogen Highway
- NW Energy Technology Collaborative
- NW Hydrogen Association

Assist Market Development

- Leverage private sector investment by delivering incentives
- Assist with demonstration projects from technical and policy perspective
- Remove institutional barriers
- Assist Oregon businesses obtain federal funding
- Provide independent review of feasibility studies

Financial Incentives

Business Energy Tax Credit

- 35 % Tax Credit
- Applies to hydrogen infrastructure and fuel cells
- Pass Through option

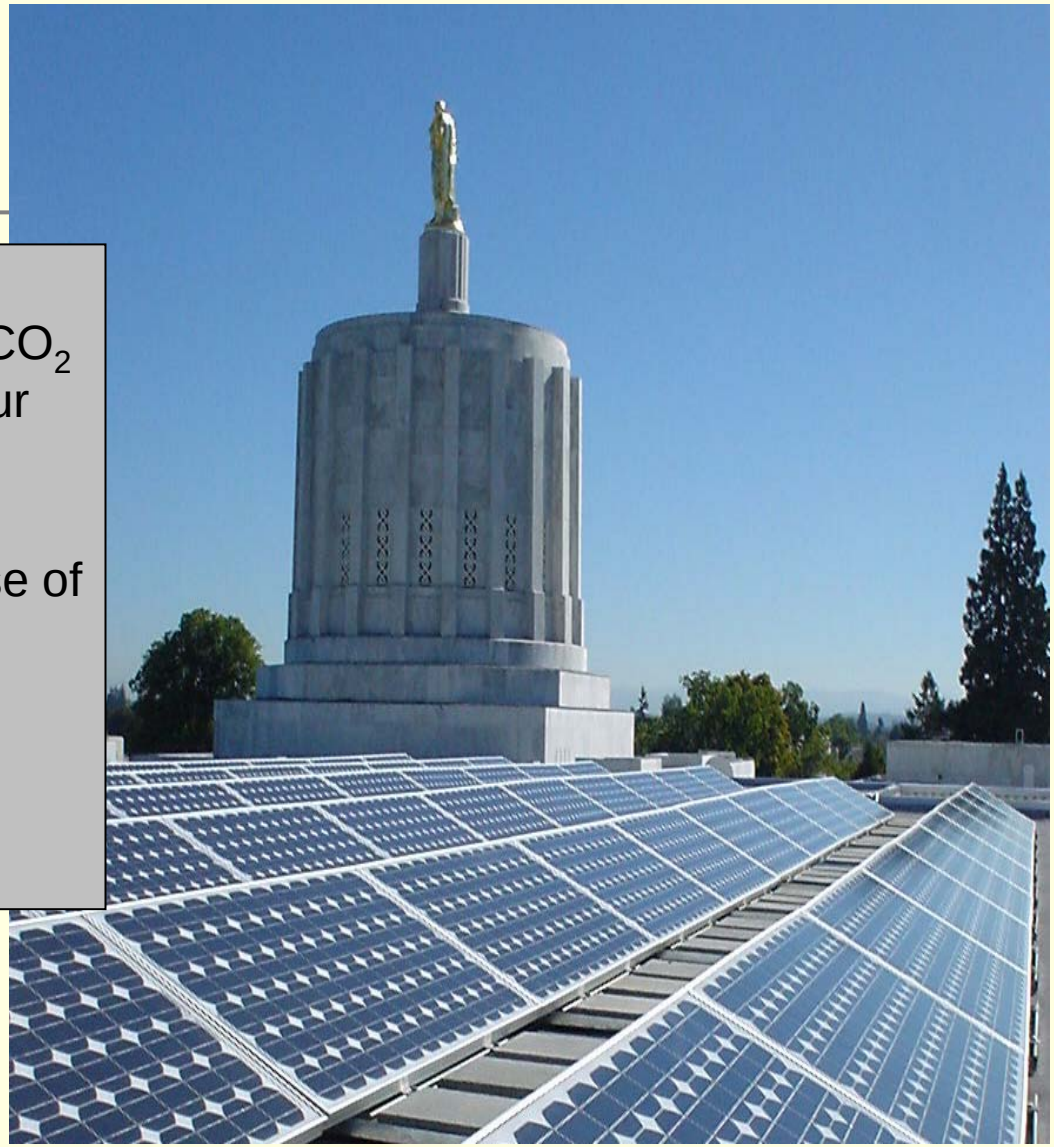
Energy Loan Program

- GO bonds for long term, fixed-rate, low-interest loans
- Alternative energy and fuel cells

Strategic Approach

- Promote the development of renewable energy resources and ‘best in class’ technologies
- Production of hydrogen from dedicated new renewable resources
- Support fuel cell demonstrations
- Continue to collect, evaluate, and clarify best thinking on hydrogen ‘source-to-wheel’ efficiency

- Based on Oregon's experience, we can limit CO_2 emissions and improve our economy.
- Education and efficient use of resources is essential.
- Renewable resources are Oregon's most beneficial resources.



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OREGON DEPARTMENT OF ENERGY