

# “*New Source of Power*”

- “A new source of power, which comes from a distillate of kerosene called “gasoline” has been produced ... instead of burning the fuel under a boiler, it is exploded inside the cylinder of the engine. This so-called internal combustion engine may be used under certain conditions to supplement steam engines...It may someday prove to be more revolutionary in the development of human society than the innovation of the wheel...Never in history has society been confronted with power so full of potential danger and ...promise for the future. “The dangers are obvious. Stores of gasoline in the hands of the people interested primarily in profit would constitute a fire and explosive hazard of the first rank. Horseless carriages propelled by gasoline engines might attain speeds of 14 or even 20 miles per hour. The menace to our people of vehicles of this type hurtling through our streets and along our roads and poisoning our atmosphere would call for prompt legislative action even if the military and economic implications were not so overwhelming.”

*circa 1875 – Congressional Horseless Carriage Committee, Cong. Record.*

MONTANA . . . . .



“ . . . . the state of energy!”

# Making Lemons into Lemonade!



# State Lemons

- Flat economy
- Disenfranchised citizenry
- No economic driver
- Non-competitive edge in market place
- Deteriorating infrastructure
- Export of youth and expertise

# National Lemons

- National energy security
- Downturn in business development
- Energy demands escalating
- Carbon fuel pollution concerns

# Key Choices for Good Economic Lemonade

1. Leadership vs. Followership
2. Innovation vs. Stagnation
3. Collaboration vs. Fragmentation
4. Proactive vs. Reactive Ed. & Training
5. Funding Streams vs. Zero Summing

# Successful Lemonade

- MT is the only state that holds the solution to an energy secure future in its: oil, gas, coal, wind, water, solar, biomass, platinum, carbon, & others
- The clear solution is a hydrogen energy
- *Window of Opportunity* --“Technological Convergence”
- Montana can be the hydrogen lemonade stand for the country
- Hydrogen = “Currency of the Future”

# Why Hydrogen?

- Most plentiful element
- Nonpolluting
- Inexhaustible
- Harnesses polluting fossil fuels
- Enhances national security
- Meets increased energy demands
- Easily transported: truck, rail, pipeline
- Powers efficient Fuel Cells

# Uses of Hydrogen

- Transportation
- Electricity Production
- Distributive Energy
  - Homes
  - Schools
  - Buildings
- Appliances
- Anything that needs ENERGY



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# Fuel Cell

- Produces electricity, heat, & water
- Runs on supply of hydrogen
- Anode catalyst splits hydrogen protons and electrons creating a current
- Silent and non-polluting
- H<sub>2</sub> Fuel Cell is 2.5 to 3 times more efficient than internal combustion engine
- Electrochemical engine

# Making Hydrogen

## Chemical Processes:

- Fuel Reforming
- Coal Gasification and Pop Corning
- Electrolysis



# Hydrogen Safety

- Hydrogen is safe/safer than conventional fuels
- Hydrogen is, in some cases safer than gasoline, LPG or natural gas.
- Hydrogen is in common use today all over the world.

# Other State H<sub>2</sub> Activity

- Ohio – Key Ec. Devel. Emphasis
- Connecticut – Bus. Partnership
- Hawaii- State H<sub>2</sub> Plan & Power Park
- California – FC Partnership
- North Dakota –Coal Gasification & Pipeline
- Florida – Coal Gasification
- Iowa – Bio Project
- Michigan— “NextEnergy”: is a comprehensive set of actions and incentives designed to position Michigan as the world’s leading center for alternative energy technology, research and development, education and manufacturing” SMART ZONES

# The Canadian Hydrogen Experience

- 2001-2002
  - 32 companies (28)
  - Revenue \$97MM
  - R&D \$179MM
  - Jobs 1772
- Projected – *Growth Environment*
  - Revenue \$165MM >70%
  - R&D \$358MM >100%
  - Jobs 2639 >49%

# Hydrogen Industries

Engineering, Hydrogen Production Equipment, Testing Equipment, Fuel Cells, Power Generators, H<sub>2</sub> Storage, Transportation, Distributive Energy Equipment, Pressure Devices and Regulators, Evaluation and Certification Services, Electrical Components, Purification Systems, Engines, Safety Products, NO<sub>x</sub> Reduction, Fuel Reformation, Gas Sensors, Carbon Sequestration, H<sub>2</sub> Gas, Risk Mgmt., Safety, + many more to come

# Education Levels

- >70% of workers in the hydrogen and fuel cell industry have a post secondary education
- 24% of Montanans have a post secondary education
- The building block of economic development is one and two year focused training

# What is Holding Us Back?

1. Leadership
2. Innovation
3. Collaboration
4. Education
5. Funding

# Progress

- [H2education.com](http://H2education.com)
- [Cte.umt.edu](http://Cte.umt.edu)
- Energy Technicians Program
- H2 Safety Training Center
- Alternative Energy Learning Center
- H2 Futures Park Campus
- H2 PRT Maglev Monorail System
- Biomass to H2 Project
- Montana Vision 2020
- Commercial Wind Site
- FutureGen and Coal Gasification