Mixtures of Hydrogen and Natural Gas (HCNG) for Heavy-Duty Applications

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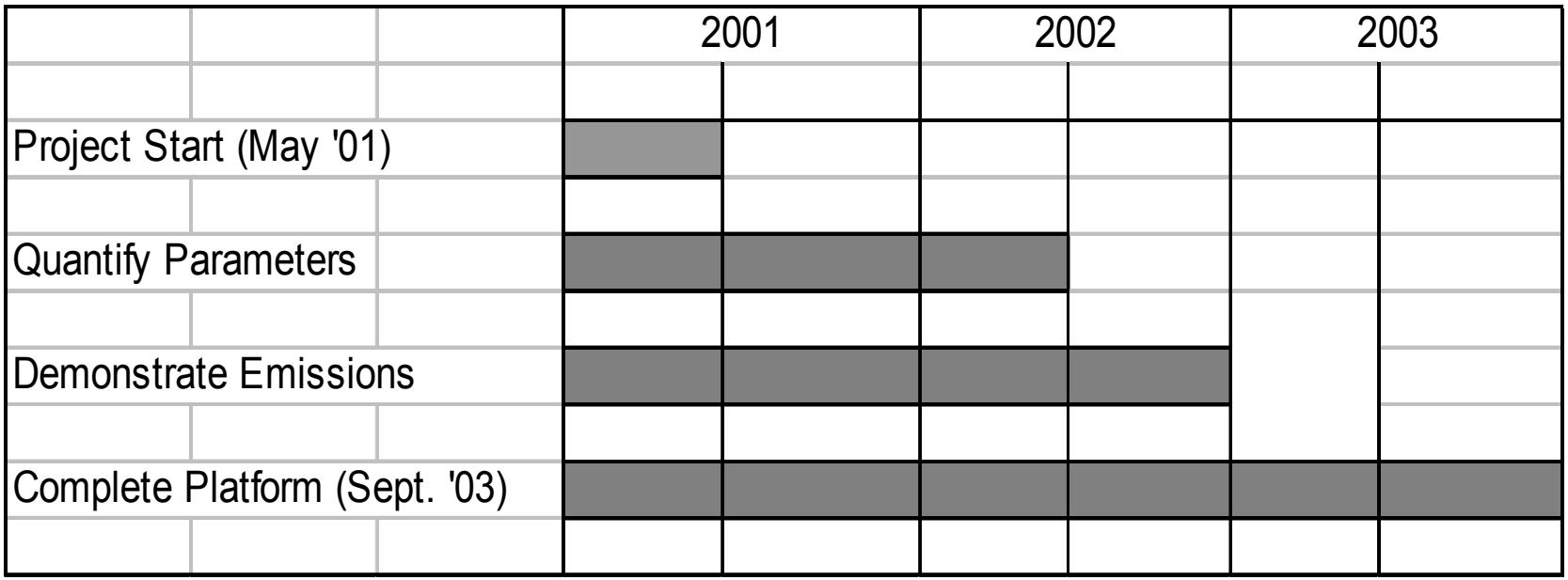
Relevance/Objectives

- Accelerate Hydrogen Refueling Infrastructure
  - Creating cost-effective applications for hydrogen
- Influence on Codes and Standards
  - Operation of vehicles will provide important data base for developing regulations.
- Enhance the Development of Electricity-Hydrogen Co-Production
  - Partnerships with electric utilities

Approach

- Use Hydrogen as an Additive to Natural Gas.
  - Reduces exhaust emissions dramatically
  - Improves engine efficiency
  - Utilizes existing engine technology
    - No new technology development required
    - No new repair and maintenance infrastructure required

Project Timeline



Accomplishments/Progress

Emissions from Las Vegas Bus Engine

Individual Modes	NOx (g/bhp-hr)	THC (g/bhp-hr)	NMHC (g/bhp-hr)	CO (g/bhp-hr)	Weighting Factor
1800 rpm - 100% Load	0.15	3.70	0.11	0.00	0.15
- 75% Load	0.12	3.86	0.12	0.00	0.15
- 50% Load	0.09	4.86	0.15	0.00	0.15
10% Load	0.13	8.82	0.26	0.00	0.1
2800 rpm - 100% Load	0.21	3.31	0.10	0.00	0.1
- 75% Load	0.15	3.77	0.11	0.00	0.1
- 50% Load	0.10	5.75	0.17	0.00	0.1
- Idle	0.22	7.21	0.22	0.00	0.15
Weighted 8 Mode (g/bhp-hr)	0.15	5.11	0.15		
Weighted 8 Mode (g/kw-hr)	0.20	6.85	0.21		

Collaborations

- City of Las Vegas
- Hess Microgen (subsidiary of Hess Oil)
- University of California-Davis
- Air Products and Chemicals
- British Columbia Hydroelectric
- Arizona Public Service Company
- Penn State University

Future Plans

- Will License Engine Design and Controls for Powering and Repowering Heavy-Duty Vehicles
  - Diesel bus repowering seen as large market
  - Natural gas bus repowering also a market
  - Cut-Away vans are viable market
  - Fleets that do not currently comply with future emissions regulations.

Previous Q&A

- Previous Work Has Not Used Conventional Heavy-Duty Engine Bases
  - Our previous work has used racing engine platforms because we could purchase components compatible with hydrogen fuel.
  - Our latest work has focused on existing heavy-duty engine platforms with components and controls designed specifically for hydrogen.