

Green Racing Initiative: Accelerating the Use of Advanced Technologies & Renewable Fuels

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DOE\EERE Vehicle Technologies Program

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U.S. Department of Energy
Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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Green Racing Initiative Overview

Use rapid pace of motorsports to develop, demonstrate, and promote advanced vehicle technologies and renewable fuels

Timeline

- Start: October 2008 (FY 2009)
- End: Open

Budget

- FY 10 Funding: \$484K
- FY 11 Funding: \$800K

Barriers Addressed

- Technology Risk Aversion
- Data Collection and Availability
- Constant Technology Development

Key Partners

- EPA + SAE International
- American Le Mans Series (ALMS)
- American Speed Association
- Michelin
- Circle Track Magazine



RELEVANCE: The Green Racing Initiative Touches All Aspects of DOE's Vehicle Technologies Program

Incorporates leading-edge examples of these VT technologies:

- Advanced SI and CI engines
- Advanced renewable fuels
- Lightweight materials
- Aerodynamics
- Energy Storage
- Advanced electric propulsion systems
- Waste heat recovery systems



RELEVANCE To All Parts of DOE Vehicle Technologies Program

- Reaches millions of racing fans with extreme-duty validations of advanced vehicle technologies
- Highly collaborative partnerships with U.S. EPA, SAE International, and multiple racing sanctioning bodies
- Involvement of 14 OEMs and four major tire manufacturers



Approach – Accelerate Development of Advanced Vehicle Technologies and Promote their Acceptance

- Promote and advance use of biofuels
- Demonstrate feasibility of advanced technologies to public
- Develop advanced engine and HEV powertrain technology
- Collect data from AFVs and HEVs under extreme conditions
- Communicate national energy policy objectives
- Showcase reduced petroleum use/GHG with better performance
- Enhance DOE image



Technical Accomplishments and Progress Summary

- Reduced ALMS petroleum use by 42% at PLM with better competition
- Incentivized switch to E85 by all major OEMs in ALMS GT category
- Introduced Porsche 911 GT3 R Hybrid in DC; raced at Road Atlanta
- Awarded 2nd season-long ALMS Green Racing Championship Awards
- Green Racing Champions receive invitations to 24 Hours of Le Mans
- Deployed HEV E85 racing simulator at multiple ALMS events
- Circle Track *Project GREEN* car tested using E85, FI, with catalysts
- *Project GREEN* car raced at national event and was competitive
- Revamped, improved web presence with expanded media outreach



Green Racing Championship for OEMs is a Highly Sought-After Recognition of Commitment to Sustainable Mobility Technologies and Competition Excellence



Technical Progress: Advancing Biofuels Use

- In 2009 ALMS season started with 4 cars using E85
- In 2010, 16 cars used E85 including 75% of the GT field
- E85-powered car captured first overall win in 2010
- Biobutanol-powered car captured first overall win in 2010
- Every GT category winner was powered by E85 in 2010
- GTL-enhanced ULSD-powered cars won overall in 2 races
- By end of season, cellulosic E85 was available for all



Technical Accomplishments: Bringing Electric Drive Technology to ALMS Racing – the Hybrids are Here!

- Worked closely with ALMS and ACO to allow, encourage HEVs
- Porsche introduced 911 GT3 R Hybrid at DOE, raced at Road Atlanta
- Collaborating on rules development, data acquisition systems
- Peugeot, Porsche introduced 2012 LMP1 HEV prototypes



Data from HEV 911 at RA



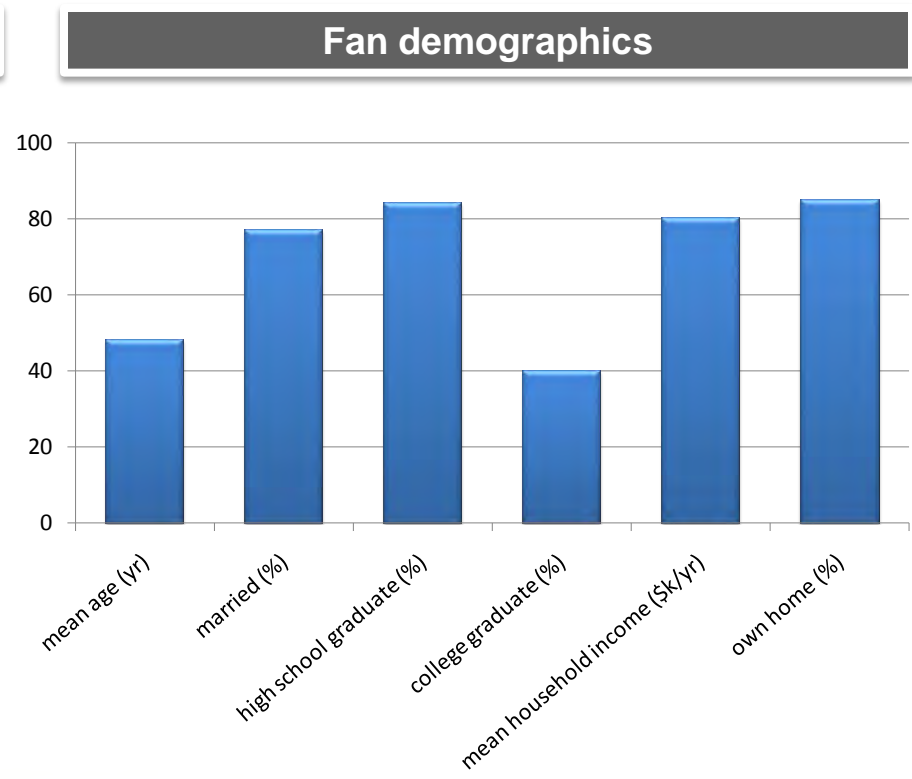
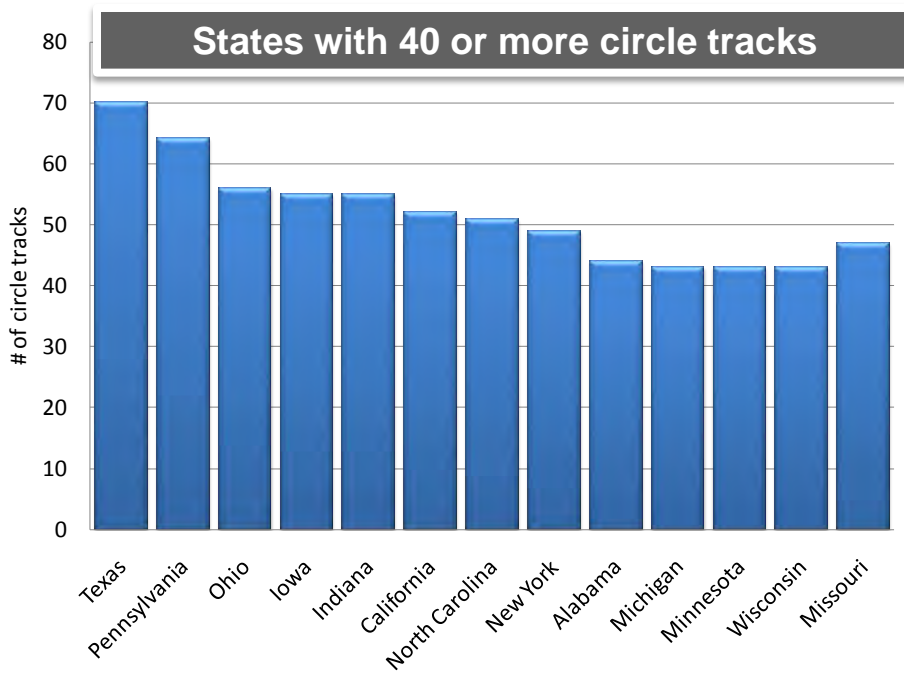
Technical Accomplishment: Green Racing HEV Simulator Found Fantastic by Thousands of Fans

- ANL-developed driving simulator gave race fans a chance to drive a Chevrolet Corvette C6R HEV on E85
- Taught importance of renewable fuels and use of recovered energy from braking to enhance performance
- Linked participation to website and e-mail list for follow-up
- Entertainment + Messaging = Education + Fun



Circle Track Racing has Tremendous Potential for Increasing Demand for Renewable Fuels and Advanced Technologies

- 20+ million people attend grassroots oval track races (annually)
- Auto racing is the #2 television audience sport in the U.S. (second to the NFL)
- Approximately 443,000 participants (teams/drivers) in the US^[2]
- Over 1,100 oval tracks in the U.S. exist - every state has an oval race track

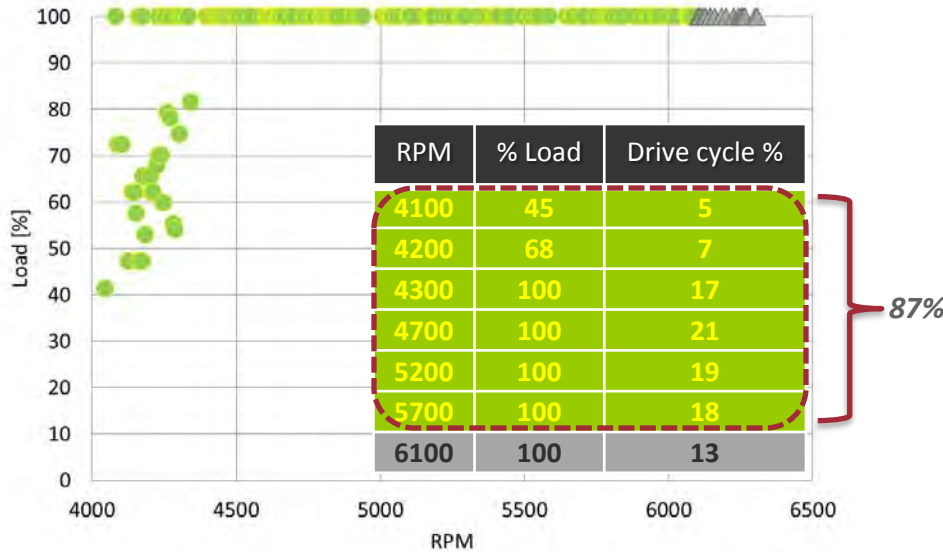


2. According to 2004 data, Circle Track Magazine

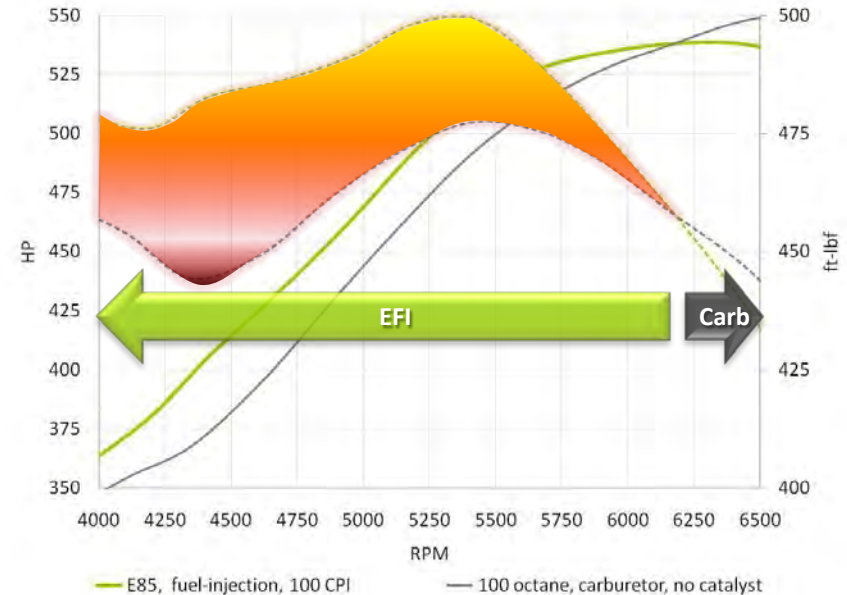


Dyno/Track Tests Detail Increased Performance on E85

On track recorded engine speed/load points. Data points color coded between EFI/E85 and carburetor. E85 more power for vast majority of drive cycle.



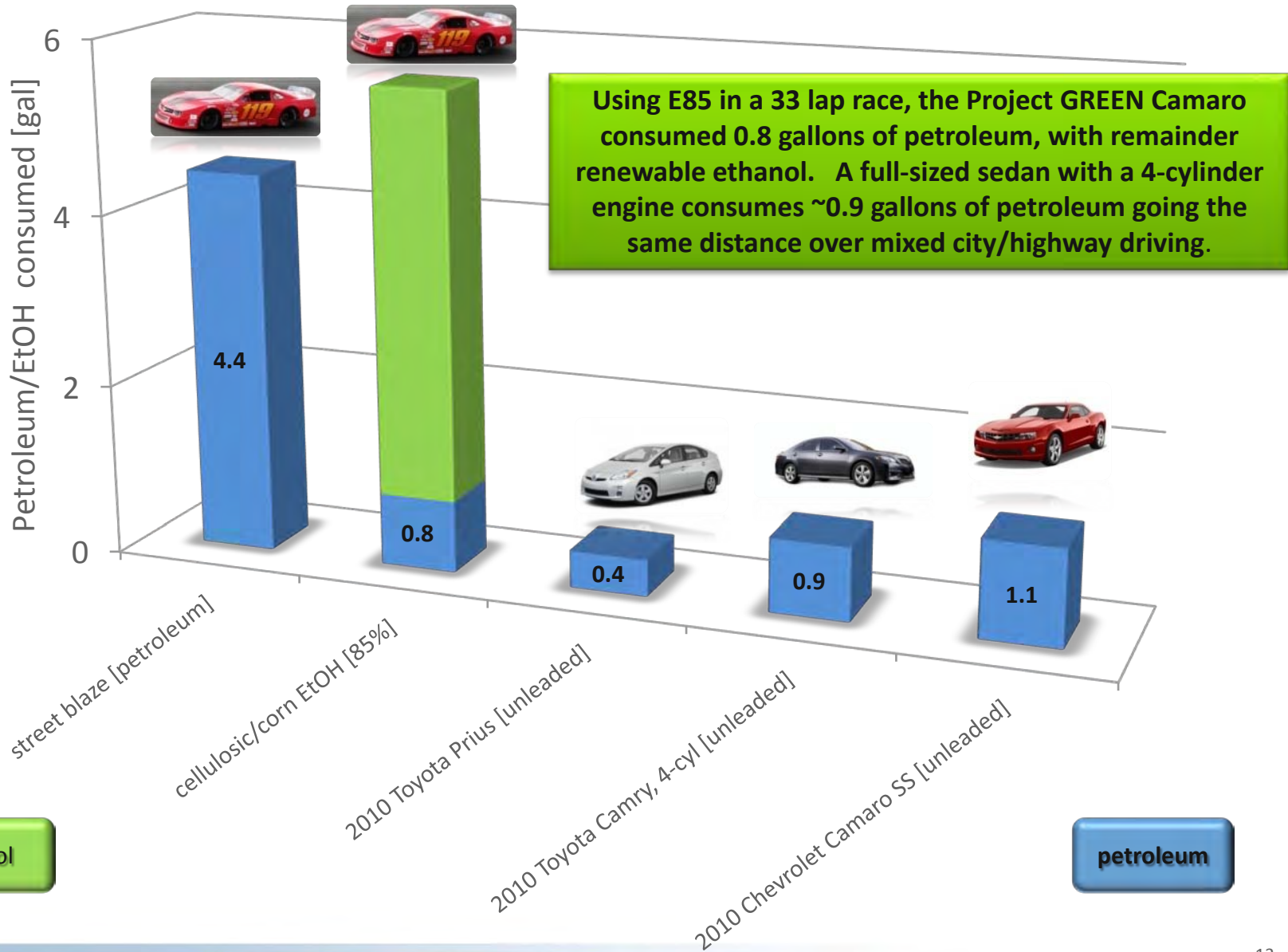
E85, EFI configuration with catalysts makes more power and torque 87% of the time weighted engine RPM/load range: Results = faster lap times.



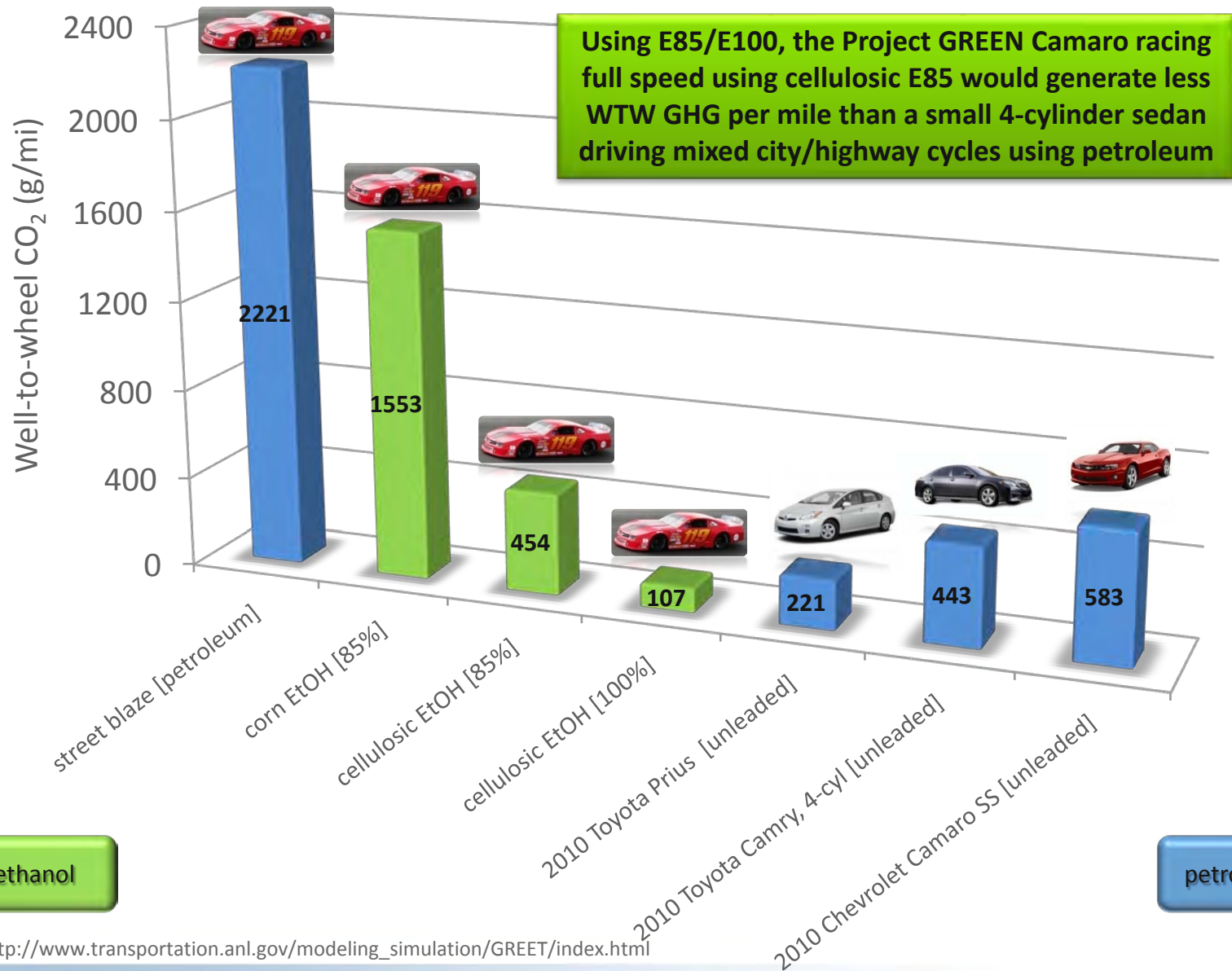
● EFI/E85: more power ▲ Carb/race fuel: more power



Petroleum Displacement for 33 Laps of Racing (~21 miles)



GREET Modeled Greenhouse Gas Emissions Results^[1]



1. http://www.transportation.anl.gov/modeling_simulation/GREET/index.html

Technical Accomplishments: Circle Track Green Racing Demonstrates Renewable Fuels and Modern Technology

- Increased performance using renewable fuels and fuel injection
- Reduced petroleum use, WTW greenhouse gases significantly
- Developed key project messages for educational outreach
 - Communicate renewable fuels and sustainability message to large audience
 - Reduce apprehension for adopting the use of newer fuels/technologies
 - Going green and going fast are synonymous
- Decreased costs dramatically for thousands of grass-roots racers
 - Reduced fuel cost by a factor of 4 compared to racing fuel
 - Reduced engine cost by 2/3; also lowered maintenance and rebuild costs
- Lower cost of racing means more racers, more demand, more jobs!



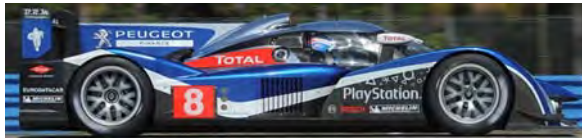
Extensive Collaboration a Green Racing Hallmark

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- Strong partnership forged with EPA and SAE International
 - OEMs involved in Green Racing Initiative
 - General Motors
 - Ford
 - BMW
 - Porsche
 - Ferrari
 - Audi
 - Honda
 - Mazda
 - Jaguar
 - Peugeot
 - Toyota
 - Nissan
 - Aston Martin
 - Lamborghini
 - American Le Mans Series
 - Circle Track Magazine
 - American Speed Association
 - Shell
 - BP
 - Michelin
 - Dunlop
 - Yokohama
 - Falken
 - Sports Car Club of America
 - Indy Racing League
 - Clean Cities Program
 - EcoCAR Challenge
 - ABC
 - ESPN 2 and 3
 - Michigan Tech



Proposed Future Work Includes More Biofuels, Electrification and Expanding to New Series

- HEVs in ALMS Prototypes emerge in 2012 – collect + analyze data



- Influence 2013 Rules for GT category to encouraging HEVs



- Set closed course speed record for BEVs in 2012



- Expand use of renewable fuels to grass roots circle track racing



- Work with OEMs to make “Green B’s” grass roots road racing

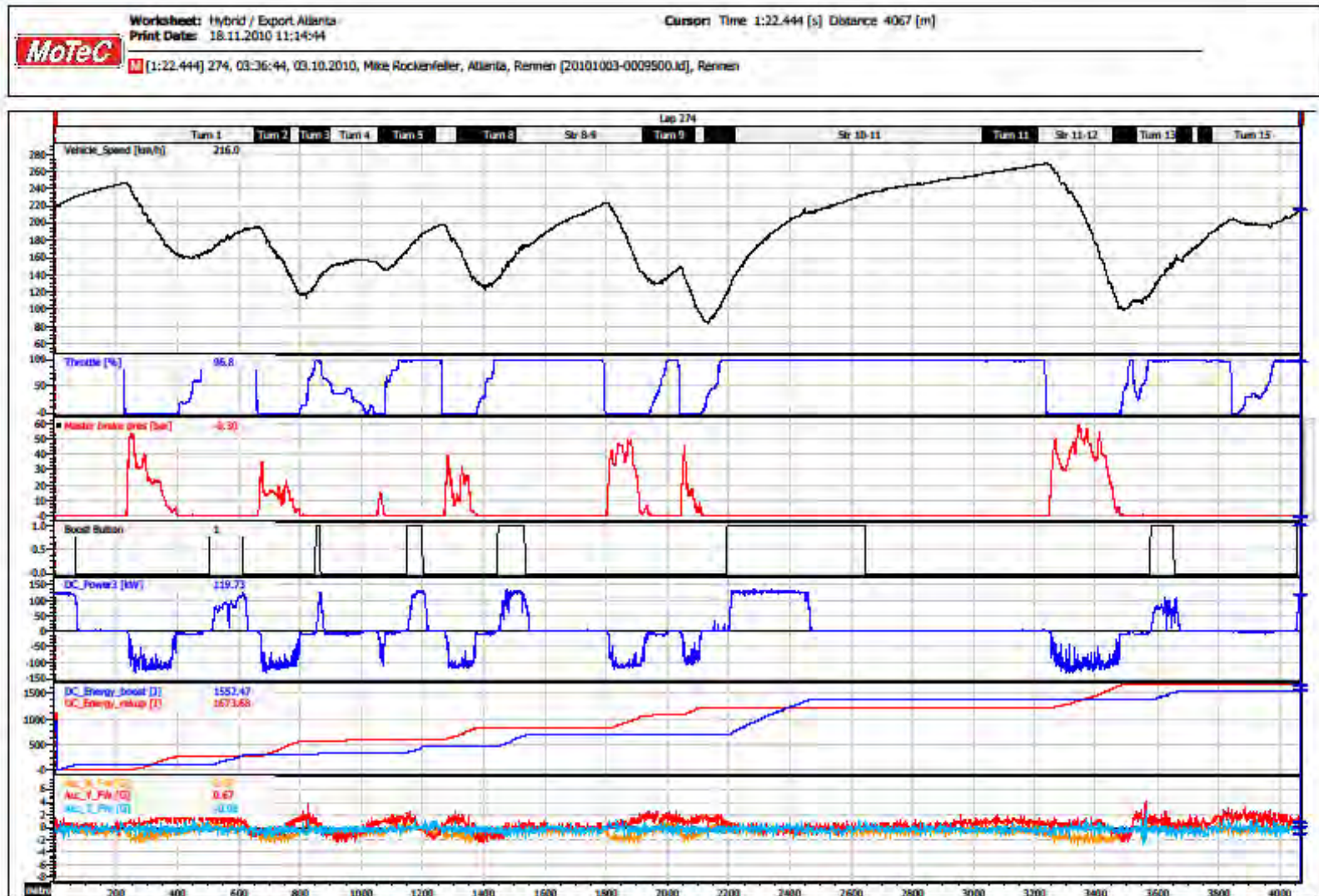


- Improve outreach and reduce risk, barriers for acceptance

Technical Backup Slides



Screenshot of Data Gathered from Porsche 911 GT3 R Hybrid Racing at Petit Le Mans – A Lap at Speed



Total Reach of ALMS in US Market Nearly 3 Million in 2010 – Does Not Count Europe, Asia, South America

Attendance	2010
Sebring	164,700
Long Beach	105,000
Salt Lake City	35,000
Lime Rock	60,000
Mid-Ohio	73,000
Road America	40,000
Mosport	80,000
Petit Le Mans	124,000
Laguna Seca	45,000
Total	726,700
Television Households	2010
Sebring	193,000
Long Beach	176,000
Salt Lake City	169,000
Lime Rock	216,000
Mid-Ohio	554,000
Road America	258,000
Mosport	136,000
Petit Le Mans	123,000
Laguna Seca	361,000
Total	2,186,000



Circle Track Accomplishments Summary: Faster, Cheaper, Cleaner, Sustainable. No Compromise Necessary

- Going green and going faster are synonymous
 - increased performance at a ~75% cost reduction
 - reduced gasoline consumption ~ 80% with domestically generated renewable fuels
 - reduced well-to-wheel greenhouse gases by ~75%
 - reduced criteria emissions by ~60%
- Circle Track racing offers huge audience for renewable fuels and sustainability
- Tremendously powerful message if cellulosic E85/advanced technology used:
 - In a 100 lap race, E85 car would consume ~2.0 gallons of gasoline, less than a 4-cylinder full-size sedan going the same distance in mixed city/highway driving
 - GREET analysis shows that less WTW GHG would be emitted per mile using cellulosic E85 in our race car than a 4-cylinder full-sized sedan using gasoline in daily driving



Green Racing Initiative Has Gained Top-Level Agency Support



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