

# Neste Oil Corporation & NExBTL Renewable Diesel

Cal Hodge  
President, A 2<sup>nd</sup> Opinion, Inc.  
On behalf of Neste Oil

California Energy Commission  
Workshop on Bioenergy  
March 9, 2006

<b>DOCKET</b>
<b>6-BAP-1</b>
DATE MAR 9 2006
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**NESTE OIL**

refining the future

**Because I have 5 minutes, here are my  
CONCLUSIONS**

**NExBTL is a 2nd generation Renewable Diesel That  
Combines the benefits of GTL-diesel and  
Biodiesel**

- Premium fuel properties like GTL**
- Reduces exhaust emissions like GTL (or even lower)**
- Fits existing infrastructure and engines**
- CO<sub>2</sub> savings like Biodiesel (or even more)**
- Renewable-reduces oil dependence**
- Provides consistent quality from diverse feedstock**
  - Waste animal fat**
  - Soy, corn, canola, rape and other vegetable oils**
- Provides a cleaner more energy efficient future**
- California needs to keep the door open to 2<sup>nd</sup> generation renewable fuels like NExBTL and Neste is ready to help**

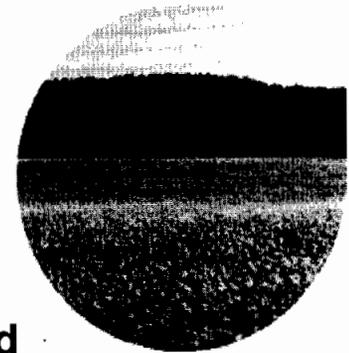
# Congratulations

- **Now I want to congratulate:**
  - **The Commissioners,**
  - **The Bioenergy Interagency Workgroup,**
  - **The Staff and**
  - **Navigant Consulting**
- **On the preparation of an excellent draft report: “Recommendations for a Bioenergy Action Plan for California.”**
- **You did a great job of capturing the pros and cons of the various bioenergy sources including recent technology and creating an action plan for implementation.**
- **I will be talking about NESTE OIL’s new technology**
  - **Its strengths and weaknesses**
  - **Why California needs it**
  - **What we need to do to make it happen in California**



## **NESTE is Ready & Able**

- **NESTE would enjoy doing a demonstration project with the CEC. But,**
- **Pilot plant work is complete and construction is underway on a 60 million gpy plant in Porvoo that will start-up in summer 2007**
- **It would be more fruitful to work with:**
  - **The California Energy Commission**
  - **The California Integrated Waste Management Board**
  - **The California Department of Food and Agriculture and**
  - **The California Air Resources Board to:**
- **To actually identify potential plant sites and feedstock sources and determine the economic viability of NExBTL technology in California**
- **A copy of this summary and more details will be added to the docket.**



## **NExBTL, A 2nd Generation Renewable Diesel**

**Exceptionally high quality diesel fuel made from on purpose or byproduct vegetable oils and/or animal fats**

- **Renewable, pure hydrocarbon fuel**
- **Superior diesel blending component**
- **Fits into existing infrastructure- no incremental costs**
- **No storage stability problems**
- **Excellent performance in cold climates**
- **Very high cetane number (84 ... 99)**
- **Free of aromatics, sulfur, oxygen**
- **Reduces NOx, PM, HC & CO exhaust emissions**
- **Less fossil CO<sub>2</sub> than fossil diesel fuel**

**It captures the benefits of both biodiesel and GTL diesel**



# Fuel Property comparison

	<b>NExBTL</b>	<b>GTL</b>	<b>FAME (RME)</b>	<b>Sulfur free Diesel fuel (summer)</b>
<b>Density at +15°C (kg/m<sup>3</sup>)</b>	<b>775 ... 785</b>	<b>770 ... 785</b>	<b>≈ 885</b>	<b>≈ 835</b>
<b>Viscosity at +40°C (mm<sup>2</sup>/s)</b>	<b>2.9 ... 3.5</b>	<b>3.2 ... 4.5</b>	<b>≈ 4.5</b>	<b>≈ 3.5</b>
<b>Cetane number</b>	<b>≈ 84 ... 99 *</b>	<b>≈ 73 ... 81</b>	<b>≈ 51</b>	<b>≈ 53**</b>
<b>Cloud point (°C)</b>	<b>≈ - 5 ... - 30</b>	<b>≈ 0 ... - 25</b>	<b>≈ - 5</b>	<b>≈ - 5</b>
<b>Heating value (lower) (MJ/kg)</b>	<b>≈ 44</b>	<b>≈ 43</b>	<b>≈ 38</b>	<b>≈ 43</b>
<b>Heating value (MJ/l)</b>	<b>≈ 34</b>	<b>≈ 34</b>	<b>≈ 34</b>	<b>≈ 36</b>
<b>Polyaromatic content (wt-%)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>≈ 4</b>
<b>Oxygen content (wt-%)</b>	<b>0</b>	<b>0</b>	<b>≈ 11</b>	<b>0</b>
<b>Sulfur content (mg/kg)</b>	<b>&lt; 10 (&lt; 1)</b>	<b>&lt; 10</b>	<b>&lt; 10</b>	<b>&lt; 10</b>
<b>Carbon / hydrogen</b>	<b>≈ 5.6</b>	<b>≈ 5.6</b>		<b>≈ 6.0</b>

**\*) Blending cetane number**

**\*\*\*) ASTM specification > 40**

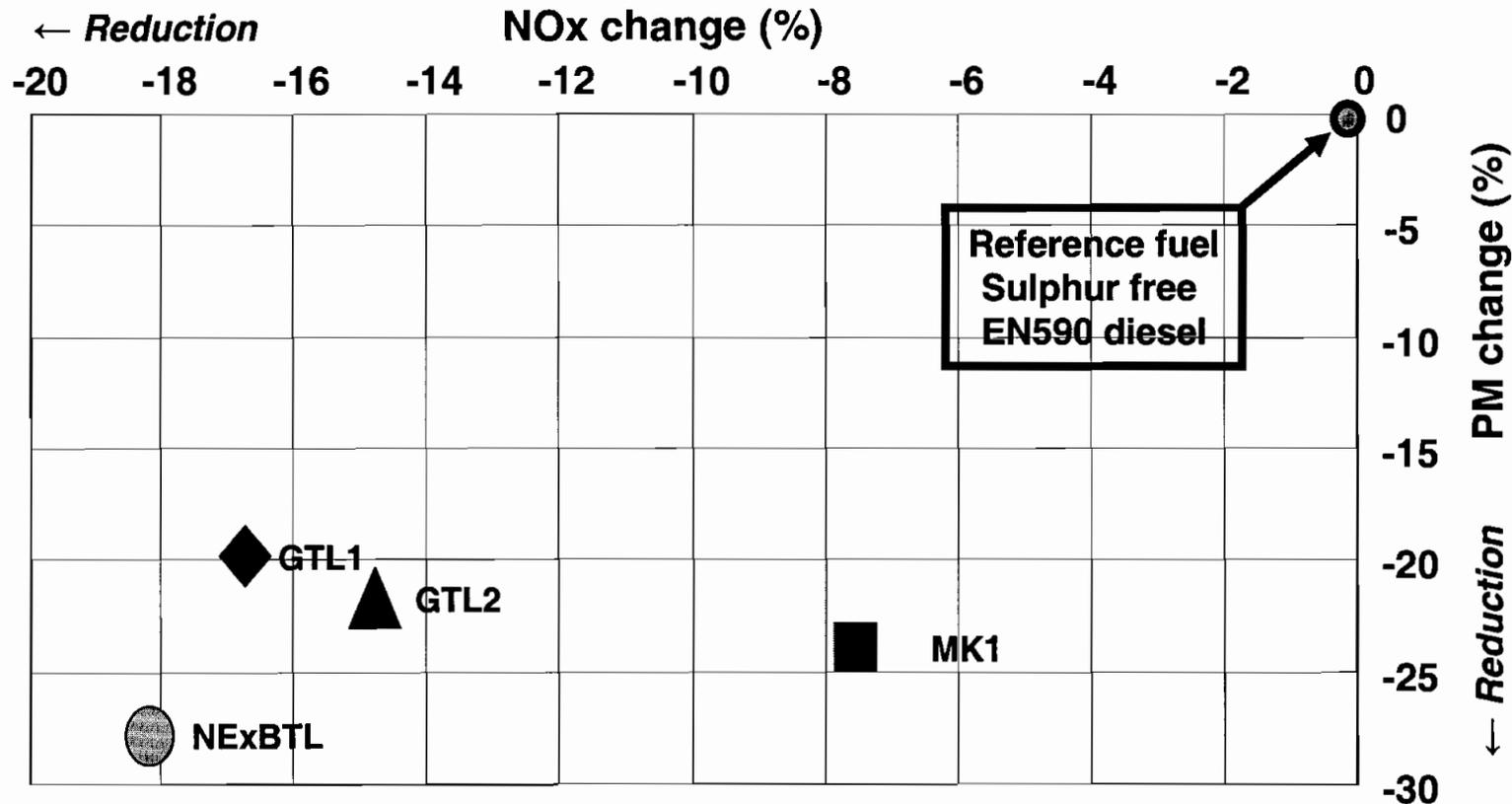


## Specifications considerations

- **NExBTL is a diesel component – It is like isooctane for diesel**
- **Only ASTM D-975 Diesel Fuel and/or CARB specifications should limit its maximum concentration**
  - **Most properties improve. Except**
  - **Like most ULSD products and GTL diesel lubricity additives are recommended.**
- **Because it is paraffins, its presence does not limit the use of biodiesel meeting ASTM D-6751 specifications.**
- **It increases the potential renewability of diesel.**
- **Standards for the use of renewable diesel fuel components need to avoid specifications that specify types of molecules or prohibit the use of second generation renewable diesel components.**



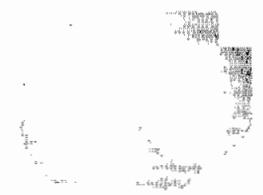
# NOx and PM Emission Changes in Truck Engines - NExBTL and Other Premium Diesels vs. ULSD EN590



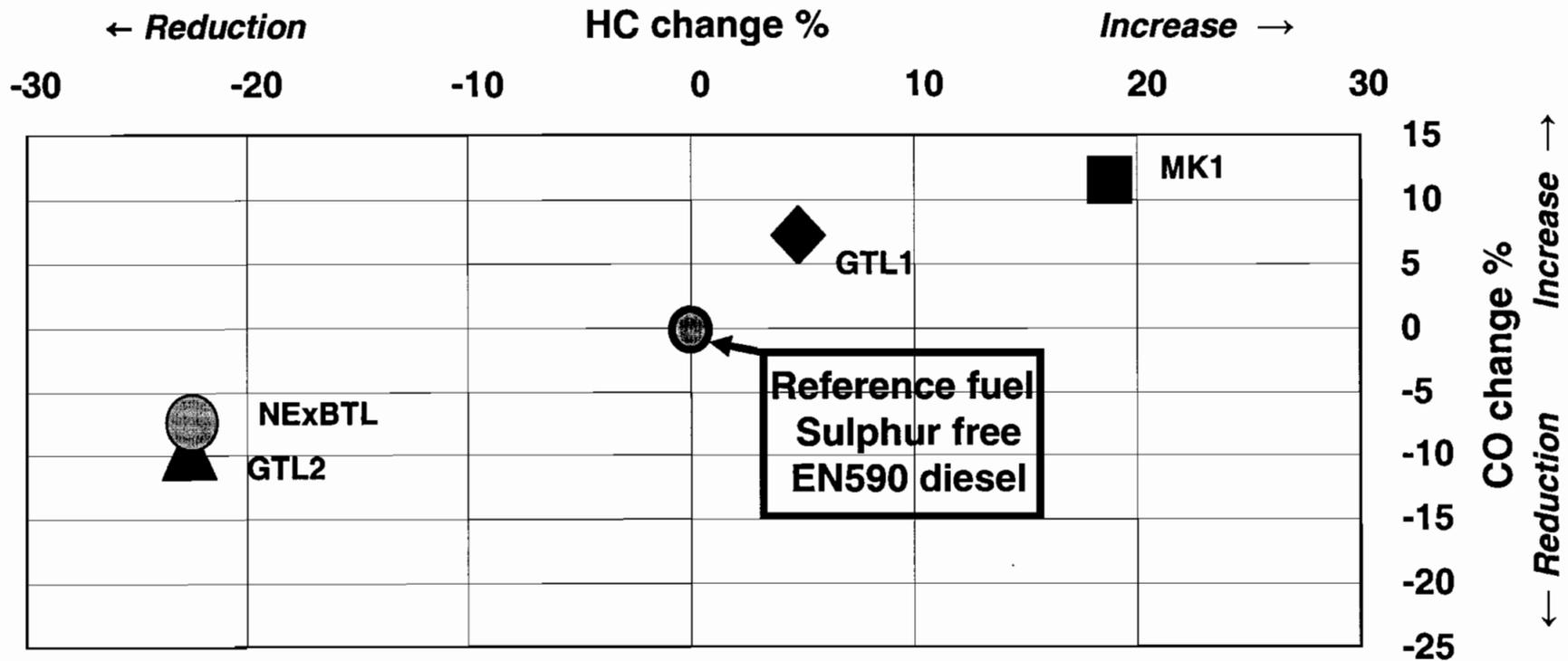
► **NExBTL results in largest reductions in both NOx and PM emissions.**

**GTL1,2 = Gas-to-Liquid diesels; MK1 = Swedish Envir. Class 1 diesel**

Source: Scania NMEC / 5th International Colloquium Fuels / Jan 12, 2005  
Averages of all tests with Scania Euro 4 engine



# HC and CO Emission Changes in Truck Engines - NExBTL and Other Premium Diesels vs. ULSD EN590



► NExBTL and GTL2 result in reductions in both HC and CO emissions, while GTL1 and MK1 are increasing the emissions.

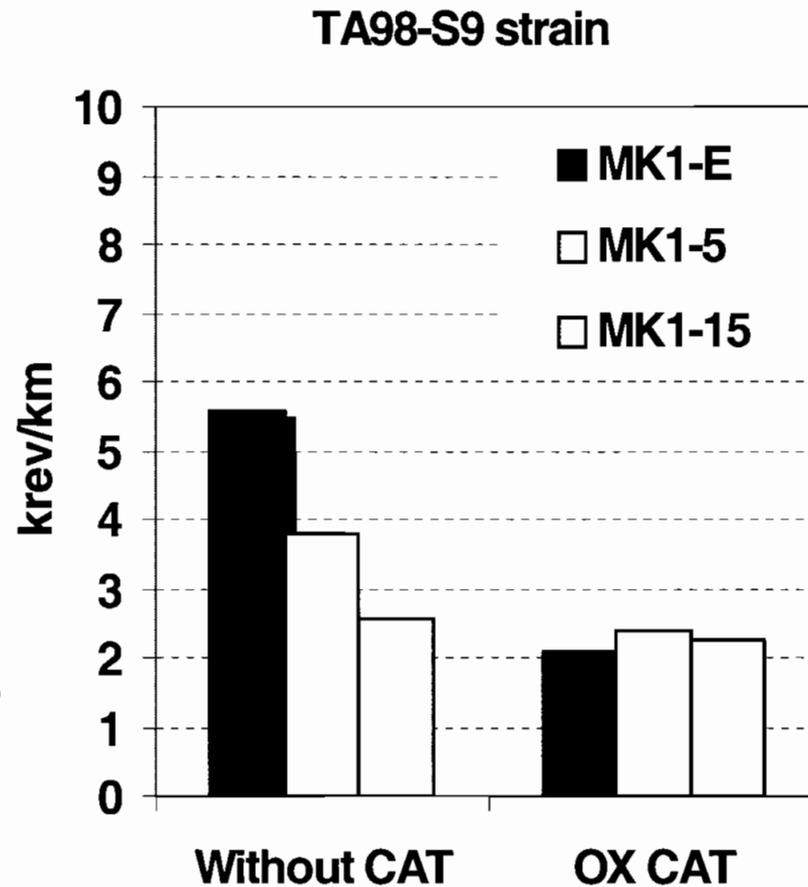
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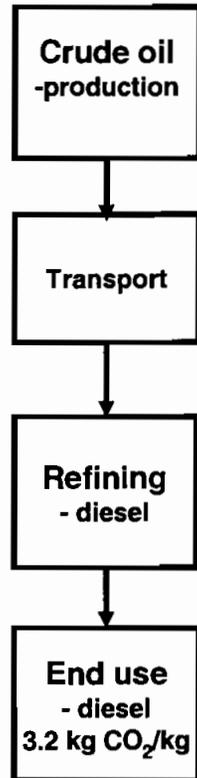
# NExBTL reduces Mutagenicity

- Adding NExBTL to Swedish MK1 almost as effective as oxidation catalyst
- Could benefit older technology vehicles



# CO<sub>2</sub>equiv. Emissions / kgoe fuel

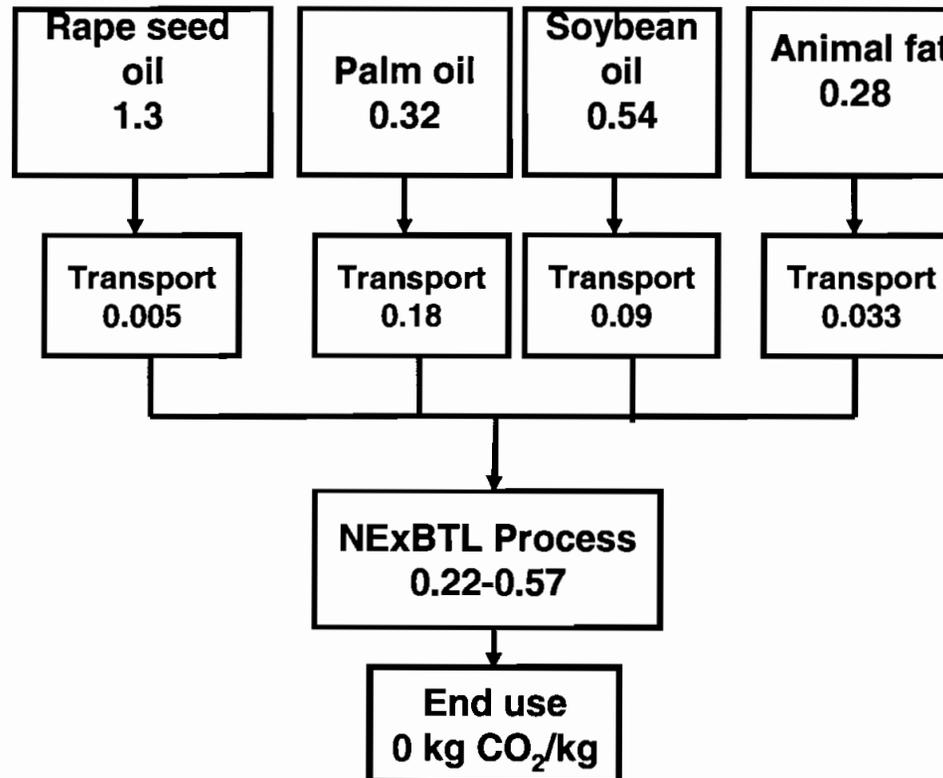
## Fossil diesel



**Σ 3.8 kg CO<sub>2</sub>/kgoe fuel**

Source: Concawe/Eucar  
WTW 2004

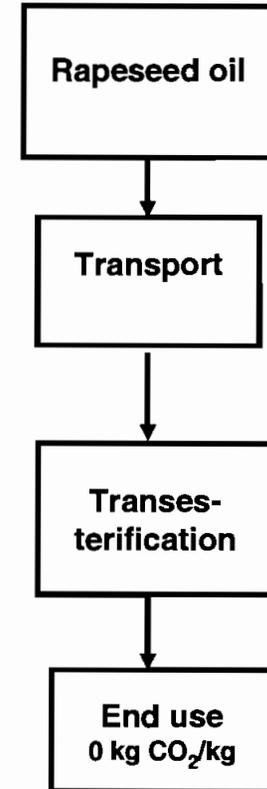
## NExBTL diesel



**Σ 0.5 - 1.5 kg CO<sub>2</sub>/kgoe fuel**

kgoe = kilogram oil equivalent (NExBTL 44, RME 38 MJ/kg)

## Biodiesel

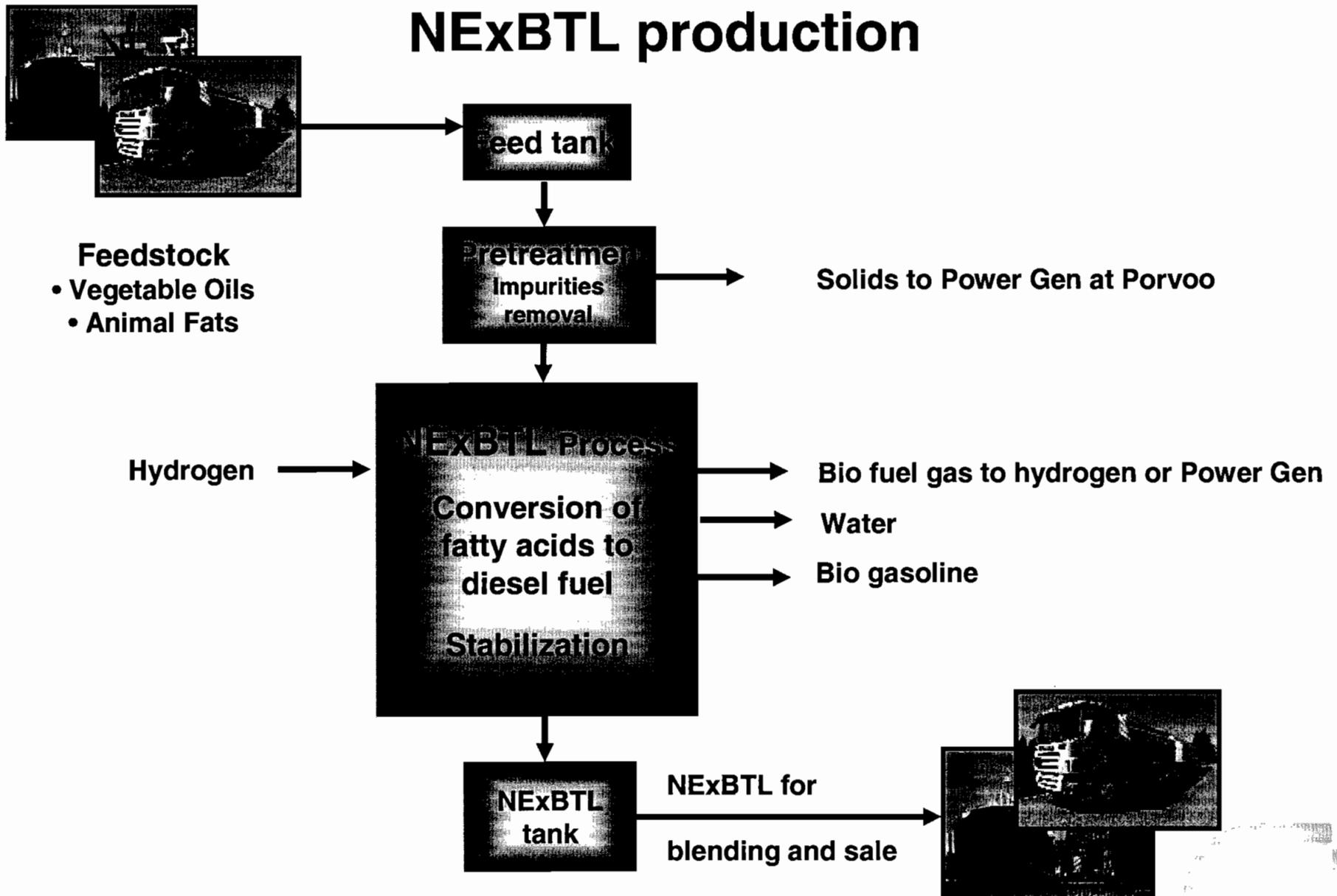


**Σ 1.6 - 2.3 kg CO<sub>2</sub>/kgoe fuel**

Source: Concawe, Shell, WTW



## NExBTL production







# California Energy Commission Bioenergy Action Plan Workshop

March 9, 2006

Robert Bosch Corp. Comments





- Ultra Low sulfur + high “quality” fuels
- Advanced engine combustion strategies
- High pressure/flexible fuel system technology
- Stabilize & introduce diesel aftertreatment systems



- Advancements of fuels
  - Bio blends – minimal (B2 to B5)
    - Combustion and aftertreatment alignment



- Bio blends – moderate (B10 or B20)
  - Bio mass
  - GtL

2006                      2008                      2010                      2012                      2014

# Biodiesel Concerns

Aging products  
(from insufficient stability)

Polymers → filter clogging  
deposits inside FIE  
seizure  
nozzle coking

Acids → corrosion  
soap formation

Peroxides → damaged seals

Note: Seals in new Bosch FIE are generally compatible with good quality Biodiesel



# ASTM D6751 / EN14214 – Relevant Parameters

Property		ASTM D 6751	ASTM D 6751 May 2005 voting	ASTM D 6751 further changes required	EN 14214
	Unit	Limits	Limits	Limits	Limits
Density at 15 °C	kg/m <sup>3</sup>	missing		not required for B100 blending	860 – 900
Viscosity at 40 °C	mm <sup>2</sup> /s	1.9– 6.0	1.9 – 5.0	5.0 max limit re-ballot for June06	3.5 – 5.0
Water content	mg/kg	max. ~500		separate test methods for evaluation of the water content and level of total contamination required	max. 500
Total contamination	mg/kg				max. 24
Copper strip corrosion (3 h at 50 °C)	rating	class 3		class 1	class 1
Oxidation stability, 110 °C, Rancimat test	hours	missing	changes declined	≥ 6.0 h for B20	6.0
Acid value	mg KOH/g	max. 0.80	max. 0.50	0.5 max passed Dec05 ASTM D02, now part of D6751	max. 0.50
Group I (alkali) metals (Na+K) Group II metals (Ca+Mg)	mg/kg mg/kg	missing missing	max. 5.0 changes declined	max. 5.0 Na+K passed Dec05 ASTM D02, now part of D6751 max. 5.0 Ca+Mg passed E0, to be balloted in D02	max. 5.0 max. 5.0



## Recommendations

Break down the discussion of biodiesel specs into stages:

- Consider how widespread the biodiesel market is and where it should be by a certain date. As noted in the 2005 IEPR, there is only enough bio feedstock and production capacity in the U.S. for a B2 to B5 blend nationwide. Beyond that there may be certain limited fleet objectives that require higher concentrations or blends of biodiesel, perhaps up to B20 as specified by EPA Act.
- Ask CARB to work with other appropriate state agencies, biofuel producers and automotive industry participants to develop a “California spec” for biodiesel quality in concentrations up to B2, B5 and B20.
- Begin this process with a mainstream, soy-based feedstock as a way to fast-track a biodiesel quality spec benchmark for all other feedstocks to follow.
- Require all feedstocks to meet the same quality standards as the benchmark.



## Recommendations (cont.)

- CARB is drafting an agreement with UC Riverside researchers to test the emissions characteristics of a potential “California biodiesel” that would be produced from state blendstocks. Add to those tests:
  - Recommend CARB and other relevant state agencies first establish a benchmark “California biodiesel” quality spec.
  - Recommend that CARB assess the impact of all biodiesel blends on engine aftertreatment systems. There seems to be very little data on this, in particular the effects on reliability of aftertreatment (particulate filter and/or NOx catalysts) performance after long-term use of biofuels.
  - Have soy-based biodiesel emissions testing as the first of many feedstocks in order to establish a baseline understanding of emissions against which all other feedstocks would be measured.
  
- Include more automotive industry representatives in the CEC’s list of “stakeholders” to insure a complete circle of expert involvement: academic, government, fuel producer, fuel user



# **California Needs a Biofuels Plan**

**March 2006**

Renewable Energy Action Project

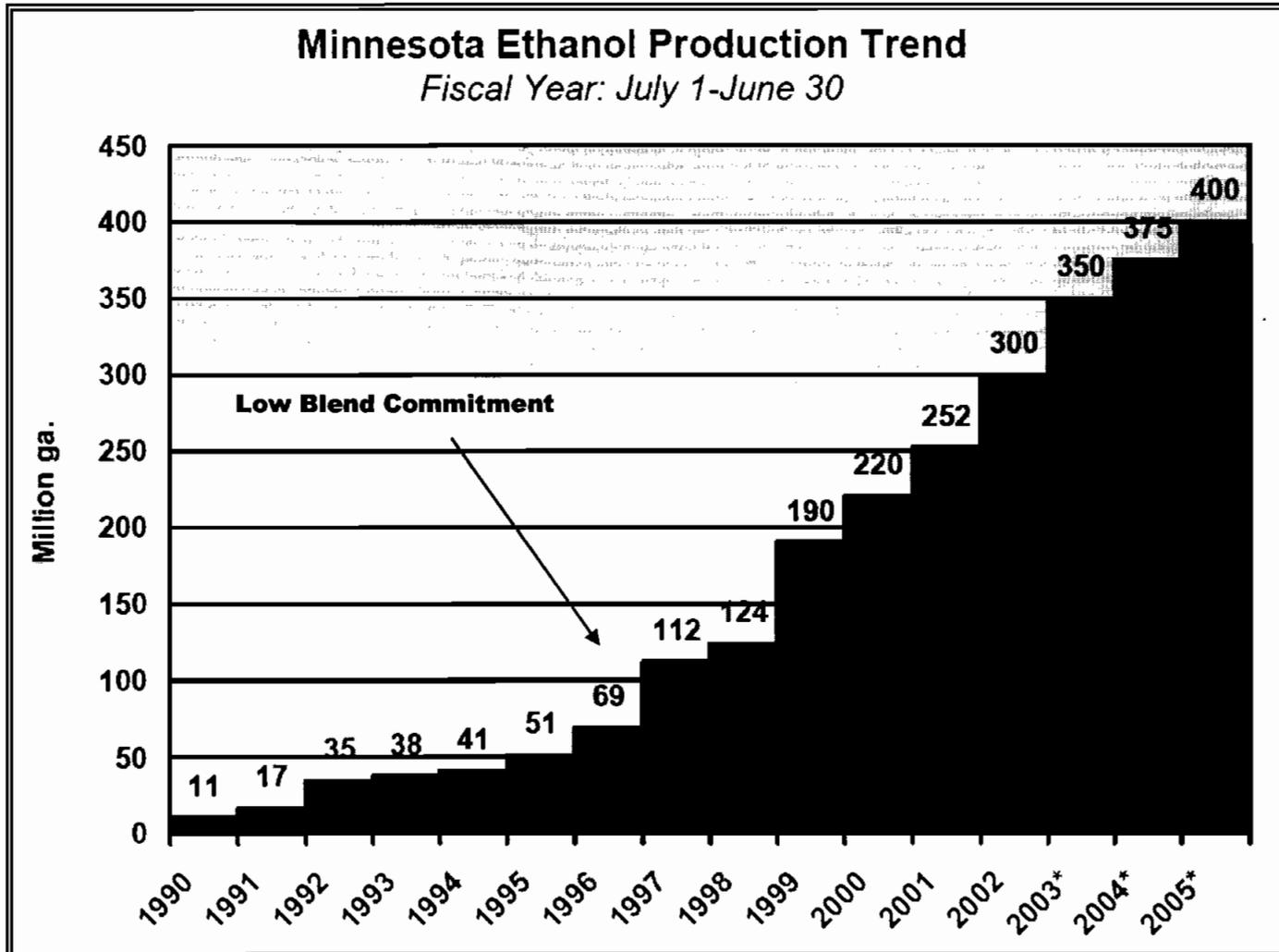
# **Current CA Environment Not Productive**

- **3+ Years of Ethanol Use as Replacement for MTBE; little in-state production**
- **Ongoing Regulatory Uncertainty Chilling Industry Growth**
- **Contrast: Minnesota nearly tripled in-state production in 3+ years once they made a volumetric commitment to biofuels**

# **The Minnesota Plan**

- **Required statewide blending via state oxygen requirement (1997) & implemented “producer payment” program in 1980s**
- **Today, for every \$1 paid for ethanol producer payments, the state earns \$16-20 in *general fund dollars***

# The Minnesota Plan



Renewable Energy Action Project

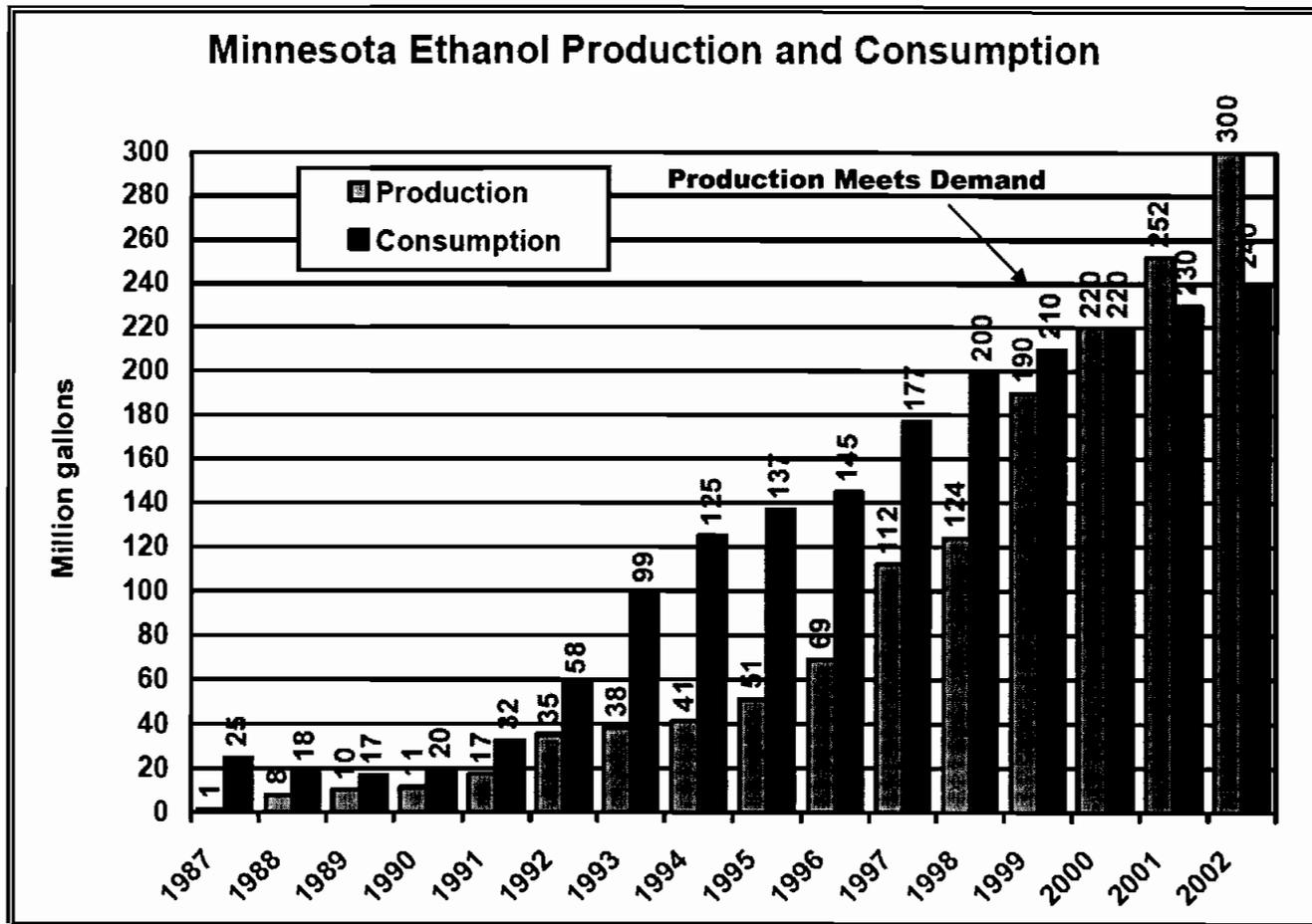
# **Minnesota Lessons E-85**

- **E-85 enjoys widespread support in California**
- **How best to promote it?**
- **Best Solution Incorporates All Available Strategies**
- **Additional Proposal:**  
***“The Overflow Strategy”***

# **“Overflow Strategy” for E85**

- ***Overflow Strategy*: commit to low blends; let low blend market overflow into high blend market**
- **Advantages:**
  - **E-85 Burden on Healthy California Biofuels Industry**
  - **Less Burden on the State**
  - **Optimizes Cellulosic R&D Dollars for California**

# “Overflow Strategy” At Work



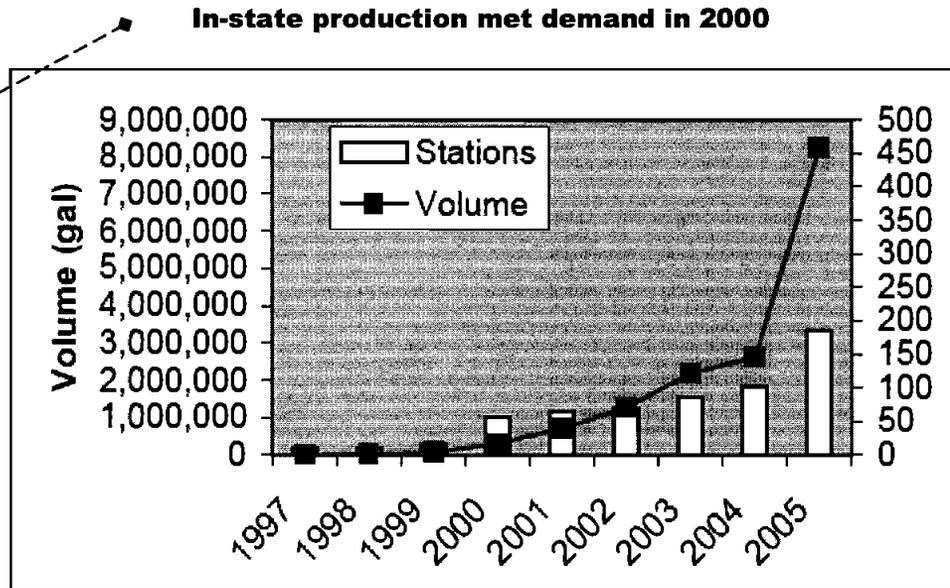
Renewable Energy Action Project

# Minnesota E85

- **When in-state ethanol production meets the demand for low blends ... overflow into high blends?**

**Historical E85 Volume Sales**

Year	# Stations Year-End	Total Yearly Volume	Monthly Station Avg Vol
1997	11	5,933	225
1998	12	37,521	288
1999	17	74,959	583
2000	56	301,152	780
2001	65	706,228	965
2002	70	1,262,318	1,479
2003	85	2,185,905	2,335
2004	101	2,611,218	2,270
2005	184	8,240,992	4,660



**Minnesota Just Opened Its 200<sup>th</sup> E-85 Station**

Renewable Energy Action Project

# **Proposed RFS A Good Solution**

- **Flexible Compliance (E6, E10, E85, B2-B20, Renewable Diesel, e-Diesel)**
- **Lets Predictive Model do its job**
- **2 billion gallons by 2020 *too conservative*; we have 1 billion gallons already; E10 would create 1.5 billion gallons.**

# **REAP Ethanol Report**

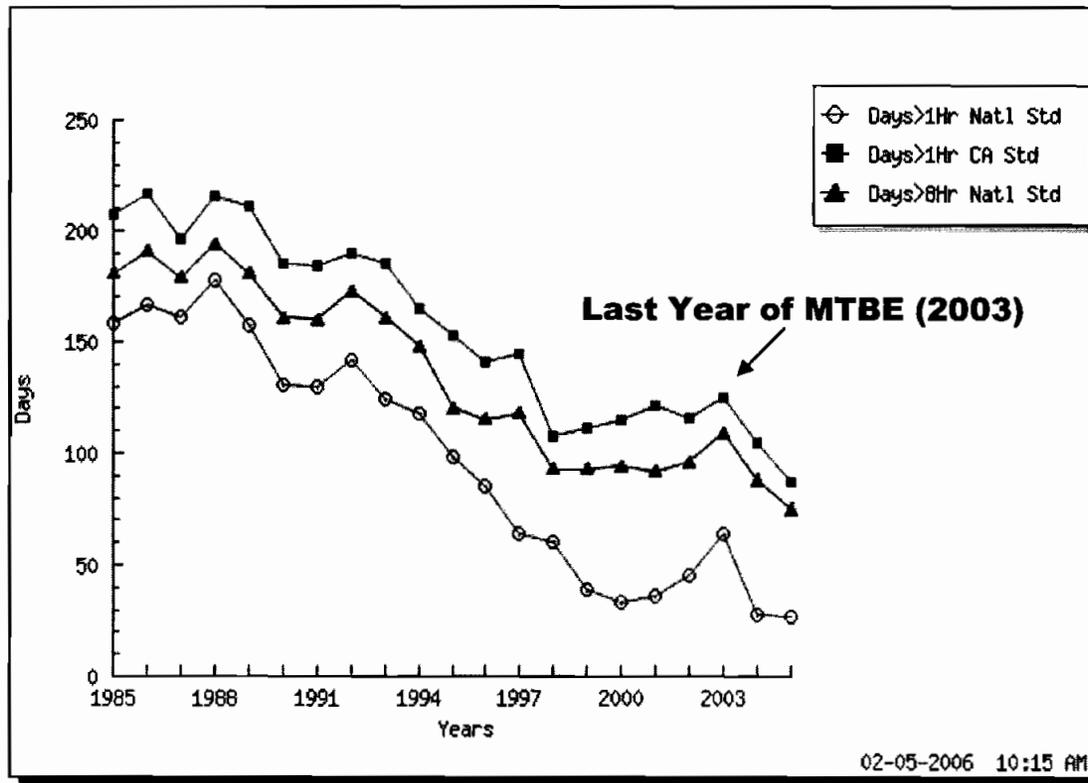
- **Recently Completed Ethanol Analysis**
- **Many states switched from MTBE to ethanol blends in recent years; we looked at air quality monitoring data**
- **AQ Modeling useful, but not the only source of data with regard to ethanol**

# CA Ozone Trends



Ozone Trends Summary: South Coast Air Basin  
8-Hour Ozone Planning Area

FAQs



Renewable Energy Action Project

# CT & NY Ozone Trends

Annual Summary Information for Ozone (CT)

Switch to E10

Annual Summary Information for Ozone								
	1998	1999	2000	2001	2002	2003	2004	2005
8-hour Ozone Exceedance Days	25	33	15	26	36	14	6	20
1-hour Ozone Exceedance Days	5	11	3	9	13	6	1	7

Switch to E10

Annual Summary Information for Ozone (NY)

	1998	1999	2000	2001	2002	2003	2004	2005
8-hour Ozone Exceedance Days	14	20	7	17	28	15	1	10

Renewable Energy Action Project

# Immediate Actions

## High Priority

- **Capture Existing Ethanol Market (1 billion gal.)**
- **Capture Low Blend Biodiesel Market**
  - **No Significant AQ Concerns**
  - **Low Sulfur Lubricity Solution**
- ***Use these two markets to Catalyze Overflow?***
- **Instruct ARB to optimize fuels regulations for non-petroleum fuel blending**

# California Secure Transportation Energy Partnership (CalSTEP)

## Input Into the CA Bioenergy Interagency Working Group



**Matt Peak**  
**CALSTART**  
**March 9<sup>th</sup>, 2006**





# What is CalSTEP?

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- **Spearheaded by CALSTART**
- **Diverse stakeholders from the private, public, and non-governmental sectors**
  - **Concerned with CA transportation fuel supply problem**
  - **Goal is to increase transportation efficiency and alternative fuel use in CA**
  - **Create more wealth and economic opportunity, while improving the environment**
- **Develop *and implement* a comprehensive pro-business “action plan” to secure California’s transportation energy future**



# CalSTEP = Multiple Solutions

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- **There is no silver bullet**
- **CalSTEP recognizes the need:**
  - **to transition from a single to a multiple-fuel future**
  - **for greater vehicle efficiency**
  - **for better transit/smart growth policies and practices**



# **CalSTEP Members -- Preliminary**

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- **George Shultz, Distinguish Fellow, Hoover Institute**
- **Dr. Maxine Savitz, The Washington Advisory Group**
- **Dr. Jim Sweeney, Professor of Management Science and Engineering, Stanford University**
- **Lars Erik Lundin, Vice President, Volvo Car Corporation**
- **Dr. Beverly Scott, General Manager, Sacramento RTD**
- **Tim Carmichael, President and Chief Executive Officer, Coalition for Clean Air**
- **Bill Jones, Chairman, Pacific Ethanol**
- **Maurice Gunderson, Managing Director, Nth Power**



## **CalSTEP Members -- Preliminary (cont.)**

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- **Dr. S.M. Shahed, Vice President, Advanced Technology, Honeywell Turbo**
- **Reg Modlin, Director Energy and Environmental Planning, DaimlerChrysler Corporation**
- **Lee Stein, Chairman, Stein & Stein (Investment Co.)**
- **James D. Boyd, Commissioner, California Energy Commission**
- **Fred Keeley, Treasurer-Tax Collector, County of Santa Cruz (former Speaker Pro Tempore, State Assembly)**
- **Doug Linney, President, The Next Generation**
- **John Boesel, President and CEO, CALSTART**



***CalSTEP Comments  
and Recommendations  
Regarding the Draft  
Bioenergy Action Plan***



# ***Bioenergy Consultant Recommendations***

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- **“Direct the California Air Resources Board to develop regulations that maximize the flexibility of using biofuels, while preserving the environmental benefits of their use. This effort should build upon the Rulemaking to Update the Predictive Model and Specifications for Reformulated Gasoline proceeding that has recently been initiated.”**
  - **“The elimination of the federal oxygenated fuel requirements for gasoline and the current lack of rules regarding the new Federal Renewable Fuel Standard (RFS) could lead to decreased ethanol use in California. The State of California should work to preserve this existing market while addressing emissions issues associated with ethanol use in gasoline.”**
  - **“Proposing minimum annual statewide ethanol consumption levels to encourage in-state production opportunities until details of the proposed state RFS are developed.”**



## **#1) “No Backsliding” on Blending**

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- By 2008, the state should explicitly incorporate a minimum pooled RFS (~6%) into its existing fuel regulatory activity.**
- Furthermore, CalSTEP strongly supports the state’s overall alternative fuel goal (20% by 2020) and supports the role of biofuels in meeting this goal.**



## **#2) Lead the Creation of Biofuel Specifications**

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- **CalSTEP recommends that the Governor direct CARB and the CEC to set fuel specifications for appropriate biodiesel blends, including B10**
- **CalSTEP encourages the state to work with the federal government, other states, or to act on its own**
  - **Create interim standards until ASTM specs are established**



# ***Bioenergy Consultant Recommendations***

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- **“Conducting a comprehensive and peer-reviewed study of the costs, emissions impacts, and fuel supply consequences of low-level ethanol blends (i.e. E6 to E10), and incorporate the study findings into the rulemaking process.”**



## **#3) Examine RFG Composition to Accommodate Higher Biofuel Blends**

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- CalSTEP recommends that CARB, in coordination with the CEC, commission a study to determine how the composition of reformulated gasoline can be changed such that net emissions do not increase when using higher biofuel blends (such as E10)**



# ***Bioenergy Consultant Recommendations***

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- **“Addressing the emissions performance, fuel supply consequences and cost issues surrounding greater use of E85 in California.”**



## **#4) Aggressively increase E85 Availability and Use**

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- **CalSTEP recommends that the state provide mechanisms for E85 growth that parallels the state's Hydrogen Highway efforts**
- **Not a regulatory driven approach**
  - **Focused on incentives, pricing, economics, and the free market**
  - **Create a climate where E85 can be competitive in CA**



# ***Bioenergy Consultant Recommendations***

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- **“Direct state agencies to purchase biofuels, bio-based products, and biopower, including combined heat and power where possible, with specific targets for 2010 and 2020. Also, encourage local governments and public institutions to follow the state’s lead.”**



# CA's FFV's Aren't Using E85

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- ***Of California's over 5,200 alternative fuel vehicles in the 2002 state fleet, only 63 (1.2 percent) were fueled with alternative fuels, leaving the remaining 98.8 percent to be fueled with conventional gasoline.***

– ***Source: California State Vehicle Fleet Fuel Efficiency Report: Volume II. Prepared by Tiax LLC for the California Energy Commission, Air Resources Board, and Department of General Services. 600-03-004. April 2003.***



## **#5) Increase and Ensure State Fleet E85 Usage**

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- **CalSTEP recommends that the Secretary of the State and Consumer Services Agency develop a plan to be used in the procurement process for vehicles *and fuels* to most effectively reduce the state fleet's petroleum consumption**
  - **Completed and delivered by the end of 2007**
  - **Ensures that the state's alternative fuel vehicles operate on alternative fuels**
    - **State implement E85 pumps at its refueling facilities**
    - **By 2010, 50% of state's FFVs operate on E85**
    - **By 2012, 90% of state's FFVs operate on E85**



**CalSTEP**



[www.calstart.org](http://www.calstart.org)