



## Making a Difference (E2 and AB 32)

On September 27, Governor Schwarzenegger signed the California Global Warming Solutions Act of 2006 (AB 32). It marked the completion of a year-long campaign by E2 members to demonstrate that California's business community supports good environmental policy and there is economic advantage to addressing climate change. This article explores the actions we took and what we expect to happen, now that California is committed by law to reducing global warming pollution 25 percent by 2020. For a summary of the history of AB 32 please see the *E2 Timeline for AB 32* (see Appendices).



Assembly Speaker Fabian Nuñez, E2 Co-founder Bob Epstein and Assembly Member Fran Pavley at the Sacramento press conference announcing the introduction of AB 32, the Global Warming Solutions Act of 2006.

### In the Beginning

In December 2004, Assembly Member Fran Pavley (D - Agoura Hills) started the process of introducing legislation to limit global warming pollution. She asked NRDC, which had cosponsored her earlier Clean Car bill AB 1493, to cosponsor AB 32 this time around. At the same time, the Schwarzenegger administration was exploring ways they could address global warming. By June 2005, the governor announced his Climate Action Team (CAT)<sup>1</sup> through Executive Order S-3-05 with the goal of reducing global warming pollution back to 1990 levels by 2020. Also during 2005, former Vice President Al Gore started to get significant visibility on climate change with what many consider the best slide show ever developed, "An Inconvenient Truth."

These developments, combined with record energy prices and wariness about record profits by the oil industry, the significant growth in "cleantech" investments, and new and increasingly alarming information about global warming impacts on California - the snow pack water supply, coastal tourism and ocean health and more - set the stage to create global warming legislation in California.

E2 members have been active on climate change since 2001 in California and since 2003 in Washington, DC. In November 2005, then California EPA Secretary Terry Tamminen suggested that E2 make the climate bill our top priority in 2006. Even though there was already activity by the governor, Terry felt the Governor's Executive Order on climate change needed the full force of law to be effective.

<sup>1</sup> CAT website: <[http://www.climatechange.ca.gov/climate\\_action\\_team/index.html](http://www.climatechange.ca.gov/climate_action_team/index.html)>.

## **Political Analysis - What it would take to win**

In order to convince the legislature to support binding greenhouse gas reduction, we needed to demonstrate the following economic benefits:

1. California would achieve a competitive, economic advantage,
2. Energy pricing and availability would improve over business as usual,
3. A significant portion of the California business community favored the legislation.

In addition, several other factors were significant:

1. The legislation needed to include protection for local communities, especially low-income communities, from being disadvantaged, as has happened with other trading schemes,
2. The legislature and Governor would need to work together - something that was not common during 2005 and would be unpredictable given 2006 election-year activities.

In the State Legislature, E2 came up with a very broad, bipartisan list of possible votes for AB 32 consisting of 51 of the 79 members of the Assembly (there is one vacancy) and 26 of the 40 members of the Senate. Legislators who, on record, doubted the reality of human-caused global warming, or those who did not believe in a cap on emissions, were not included on the target list.

Our list of possible "yes" votes broke down into four categories: strong environmental supporters, Latino caucus, business Democrats and moderate Republicans.

## **Solving Global Warming One State at a Time**

In January 2006, we published our first position paper entitled *Solving Global Warming One State at a Time*.<sup>2</sup> This paper documented the four economic advantages of AB 32:

- Energy cost reductions through efficiency
- Competitive alternative power/fuel sources
- Public health benefits from cleaner air
- New competitive industries

On February 16, E2 and NRDC organized a meeting with Senate Pro Tem Don Perata and his senior advisors, laid out the rationale and strategy for AB 32 and requested that Senator Perata make its passage his priority. He agreed.

At the end of February, we began the effort to get co-authors for AB 32. Co-authors are listed in the text of the bill itself and make a strong public statement of support in advance of any vote. A co-author is not a guarantee of a vote and it is not uncommon for a legislator to drop off, complaining about changes in the bill's language. A typical bill will have a few co-authors sometimes a dozen. AB 32 would end up with 40 co-authors plus the two authors, the Speaker and Ms. Pavley in the Assembly and 15 coauthors in the Senate.

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<sup>2</sup> Environmental Entrepreneurs. [Solving Global Warming One State At A Time](http://www.e2.org/jsp/controller?docId=9487). 2006 January. Available online at <<http://www.e2.org/jsp/controller?docId=9487>>.

## Two Breakthroughs in April

In April, the first major breakthrough of the campaign occurred when the bill's author, Assembly Member Fran Pavley, persuaded Assembly Speaker Fabian Núñez to co-author the bill and make its passage his priority. We had the leadership of both the Senate and Assembly aligned on the bill.

Speaker Núñez and Assembly Member Pavley hosted a press conference on April 3 highlighting business support for AB 32. E2, the California Ski Industry Association and California Interfaith Power and Light were featured speakers. AB 32 was officially named the Global Warming Solutions Act of 2006 and all of the key elements in the final bill were contained in the April language. Speaker Núñez told us privately that we should all make it our goal to get 41 co-sponsors before the bill came to a vote in the Assembly. At the time, we had 15.

Governor Schwarzenegger held a public summit in San Francisco on April 11 to discuss the results of the Climate Action Team report. E2 was invited to be on the panel. During the meeting the Governor made a comment which left it unclear whether he supported a firm cap on emissions. The next day he clarified in an interview at U.C. Davis that he favored a cap starting in 2012 and thought this was consistent with legislation that was being planned by Assembly Member Pavley.

## The Opposition

The opposition immediately started releasing their own reports. The major opposition included the California Chamber of Commerce, a newly formed front-group for the chamber and oil industry called Sustainable Economy and Environment of California (SEECalifornia), the cement industry, the oil industry and most of the organized farm community. The opposition initially focused on a few points: (1) reductions could only occur by limiting energy availability, resulting in shortages and higher prices, (2) high energy prices would result in businesses leaving California and polluting elsewhere where emissions might even be higher due to weaker environmental regulations, (3) California's reductions are too little to matter on a global scale, and (4) global warming needs to be addressed at the national level and international level (i.e. what about China and India?).

Each year, as part of its lobbying effort, the Chamber of Commerce announces its list of "job killer" bills. AB 32 won their top spot. During the Schwarzenegger administration, they have been very effective at stopping bills on their list. However, it was clear early on that the Chamber wasn't going to get the Governor's office to block the bill. The CAT report demonstrated that a 25-percent reduction was economically beneficial. The political popularity of addressing climate change was very broad in California, thanks in part to years of work by the environmental community, the work of former Vice President Gore and activities like Laurie David's Virtual March ([www.stopglobalwarming.org](http://www.stopglobalwarming.org)).

The Chamber and SEECalifornia sponsored economic analysis attempting to show economic harm from AB 32. Over the course of the summer, the analysis was refuted<sup>3</sup> - in particular, an

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<sup>3</sup> Hanemann, W. Michael. Review of Economic Arguments Against AB32. 2006 August. Available online at <<http://www.e2.org/ext/doc/Hanemann%20Review%20of%20Economic%20Arguments%208-10.pdf>>.

August 16 University of California, Berkeley, study<sup>4</sup> powerfully showed both the benefits of AB 32 and the flaws in the opposition's arguments. By August, the economic models showing AB 32 to be neutral to positive were broadly accepted by legislators.

### **Getting to 63**

To pass a bill into law, a minimum of 63 votes are needed - 41 in the Assembly, 21 in the Senate and one from the governor. Building this support during May through August consisted of a large number of face-to-face meetings. Given that economic issues were so pivotal to the legislators' decision about the bill, E2 made it our business to know how every member would vote, what objections or concerns there might be and who might best address them. Following every one of our 124 meetings with Assembly and Senate members, we sent written reports within 24 hours to the Speaker's staff and to Ms. Pavley.

As expected, we needed to show that the emission reductions were possible, that they would have a positive economic effect, that the environmental justice issues were addressed and that there was business support.

During July, we developed two fact sheets (see Appendices for both). The first, an extension of the CAT report, identified 24 percent more reductions in global warming pollution than needed to return to 1990 levels - *California Global Warming Solutions Act: Cutting pollution while strengthening the economy*. The second report looked specifically at how to reduce emissions from transportation fuels - *Developing Low Carbon Ethanol for California*.

### **Expanding Business Support**

While the facts supported our arguments, we needed the broadest possible business support for the bill - beyond what E2 represented by itself. E2 members focused on getting some of the major business groups to support AB 32. By the day of the final vote, the San Francisco Chamber of Commerce, The Bay Area Council, the Silicon Valley Leadership Group, The New Voice of Business and the Small Business California, PG&E, CalPine and Waste Management had all become supporters.

The turning point for business support occurred on August 16. E2 and the "Greentech Innovation Network" - a new group started by the venture firm Kleiner Perkins Caufield and Byers conducted a joint trip to Sacramento including a press conference with the Speaker and Assembly Member Pavley. The event was extensively covered by the media with a new breakthrough headline, "Businesses divided over California global warming bill."<sup>5</sup> In fact, that day, we picked up the 41st co-sponsor in the Assembly. While we could not take anything for granted, we felt we had the minimum votes needed for passage and our main problem turned into something more basic - the need to negotiate the final bill language.

### **Bill Language**

The major architecture of AB 32 stayed the same from re-introduction in April to passage on August 31. The details were negotiated by the sponsors, including NRDC, the authors (Núñez

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<sup>4</sup> Roland-Holst, David. *Economic Growth and Greenhouse Gas Mitigation in California*. University of California, Berkeley. 2006 August. Available online at <<http://calclimate.berkeley.edu/>>.

<sup>5</sup> Gardner, Michael. "Businesses divided over California global warming bill." *Daily Breeze/Copley News Service*. 2006 August 20.

and Pavley) and Senate leadership (Perata) and the governor's team led by CalEPA Secretary Linda Adams. Negotiations were more or less continuously from the date the bill passed out of the Senate Environmental Quality committee on June 26 until the final language was announced on August 30 at 2:00 PM, 34 hours before the end of the 2006 legislative session.

The negotiations were played out in the press as well as within the walls of the Capitol. The points of contention focused on three issues: (1) what types of emissions trading to allow and how to protect local communities against disproportionate impacts, (2) what emergency powers would be available to extend reduction dates and (3) what sort of regulatory governance structure would be appropriate to implement the bill. During the process, E2 talked to all the parties, offered our opinions on what types of trading made sense and encouraged everyone to continue discussions.

Each day, we would arrive and expect the language to be available - only to have to come back the next day. End of session on August 31 was the only firm deadline. Finally, on the evening of August 29th, in a private meeting with the Speaker's office, E2 joined NRDC, Environmental Defense, and several other environmental groups, to review the final bill language agreed upon between the Senate and the Assembly and soon to be transmitted to the governor. At that time no one knew whether the language would be acceptable to the Governor's negotiating team.

### **August 30**

On August 30, the full E2 AB 32 team arrived early in the Capitol expecting the final language to be released by 9:00 AM. But the Speaker was having a final meeting with the governor, and that bill language wasn't available. Their meeting did not end in a decision so we had to be prepared to move forward not knowing whether the governor would threaten a veto or just be silent on the bill (as we would normally expect).

We were called into the Speaker's conference room about 1:00 PM and Speaker's staff informed us that the governor was still considering all options on the bill. Forty-five minutes of intense negotiating and direct communication with the administration were followed by a surprise announcement. At 1:45, Speaker Núñez arrived with news none of us were expecting: the governor would release a press statement announcing his intention to sign AB 32, and right after that we would participate in a press conference with Speaker Núñez, Senate Pro Tem Perata, and Assembly Member Pavley. Along with the bill sponsors, NRDC and Environmental Defense, E2 was asked to speak for the business community of California that believed AB 32 was an economic opportunity.

The press conference received international attention and the announcement of the pending legislation was recognized as one of the most important developments in combating global warming. However, no vote had yet taken place.

### **The Vote**

E2 members took copies of the bill to every office we had visited over the last six months, explained how it met the needs of that office, showed them where their suggestions had been incorporated and confirmed their support.

While most legislators were pleased and affirmed their support, several were not happy with the negotiation process leading to the final bill language, resulting in the loss of several votes. Late in the evening of August 30, Senator Perata presented the bill on the Senate floor and the

Senate approved AB 32 by a vote of 23-14, with three members not voting.

Midday on August 31, Speaker Núñez presented the bill on the Assembly floor and after more than an hour of heated debate, the Assembly approved AB 32 by a vote of 47-32.

On September 27, with great fanfare, Governor Schwarzenegger signed AB 32 into law. During the ceremonies, E2's active involvement was acknowledged and E2 members Tony Bernhardt and Marc Stolman were invited onto the stage to witness the signing.

### **What's Next**

The hardest part of any law is not the vote, but the implementation. While E2 believes AB 32 will be the turning point for the U.S. addressing global warming, most of the work still remains to be done. The process of writing and approving the regulations to implement the reductions will take five years. During that time, many of the greenhouse gas emitting businesses will do their best to make their share of the reductions as small as possible and opponents of the bill will do their best to derail the process.

E2 will continue to build business support and to help the California business community develop low-carbon solutions faster than required by law. By proving that the marketplace can innovate and create economic growth while cutting emissions, we will be making good on our claims that solving global warming is an economic opportunity.

### **Thanks**



E2 California Climate Team members Marc Stolman and Tony Bernhardt with Assembly Member Fran Pavley at the AB 32 signing ceremony on Treasure Island.

AB 32 was the largest project ever undertaken by E2. Our thanks, first and foremost, go to the staff at NRDC, who were key to every aspect of the bill. We also had the pleasure of working with staff from Environmental Defense, Union of Concerned Scientists, Environment California, Sierra Club and American Lung Association. We worked as a team with other business groups including Greentech Innovation Network, New Voice of Business, the San Francisco Chamber of Commerce, Bay Area Council and Small Business California.

E2 members Tony Bernhardt and Marc Stolman made trips throughout California, took countless meetings in Sacramento and wrote papers to support our campaign. E2 members and friends who wrote op-eds, held district meetings or came to Sacramento include Andrew Beebe, Dayna Bochco, Eric Bowen, John Cheney, Dave Edwards, Bob Epstein, Bob Fisher, David Groves, Anna Halpern-Lande, Nathalie Hoffman, Noelle Leca, Nicole Lederer, Peter Liu, David Rosenstein, Guy Saperstein, Steve Silberstein, John Slingerup, Lee Stein, Kathleen and Stephen Unger, Elizabeth Wiatt, Robert Wilder and Paul Zorner. GIN members who came to Sacramento include Aimée Christiansen, Google.org; John Doerr, Kleiner Perkins Caufield & Byers; Larry Gross, Altra; Felix Kramer, CalCars; Jack Newman, Amyris; Ellen Pao, Kleiner Perkins Caufield & Byers; and Dave Pearce, Miasole.

Our final thanks go to Assembly Member Pavley, Speaker Núñez, Senate Pro Tem Perata and Governor Schwarzenegger, all of whom encouraged us and provided the leadership to address global warming in the state of California.

**Appendices begin next page**



## *Timeline for California Global Warming Solutions Act of 2006*

- December 2004 – Assembly member Pavley introduces AB 32 and starts discussion about what it should include
- May 2005 – AB 32 is amended to include a mandatory cap
- June 2005 – Governor Schwarzenegger announces CAT with goal of 25% GWP reduction by 2020.
- July - August 2005 – E2 works with NRDC climate and advocacy teams to identify CAT actions which need legislative mandate (eg mandatory reporting and statewide GWP cap)
- November 2005
  - CalEPA Secretary Terry Tamminen suggests E2 make GWP reductions our priority legislation for 2006
  - E2 works with NRDC & Ms. Pavley to define AB 32 strategy
- January 2006:
  - E2 AB 32 team kickoff meeting
  - E2 and NRDC meet with Ms. Pavley to discuss AB 32 policy
  - VC letter & testimony at CAT hearing
  - E2 newsletter highlights our strategy for AB 32
- February 2006:
  - E2, NRDC and constituents meet with Senate Pro tem Perata to secure his support for AB 32
  - E2 newsletter highlights how to reduce use of gasoline and replace with low-carbon alternatives
  - E2 delegation holds 19 meetings with legislators in Sacramento highlighting AB 32
- April 2006:
  - Speaker Núñez agrees to be co-author
  - E2 participates in AB32 announcement with Speaker Núñez and Fran Pavley
  - E2 participates on Governor's panel on Climate
  - Governor announces his interest in a bill "like Pavley's"
  - NYT columnist Thomas Friedman joins E2 at an EcoSalon and highlights the important role California plays on climate issues
  - Start individual meetings with legislators by E2 AB 32 team – 23 held in April
- May 2006:
  - During May, E2 members hold 15 meetings with legislators
  - Start to approach other business groups for endorsements
  - E2 delegation visits Washington requesting support for AB 32 and requesting that Federal legislation not exclude states from exceeding Federal requirements.
  - E2 requests that KPCB get involved through the GIN group
  - Southern California E2 EcoSalon held. E2 volunteers identified
  - San Diego Union Tribune Publishes Op-ed written by two E2 members



- June 2006:
  - During June, E2 members hold 26 meetings with legislators
  - June 26 Senate environment committee approves AB 32 5 to 2
  - E2 works with NRDC consultant to bring in and organize broader business support for AB 32
  - With E2's help, the Bay Area Council, Small Business California, and New Voice of Business endorse AB32. Many business associations follow with their own endorsements.
- July 2006:
  - During the July legislative recess, E2 members hold 5 meetings with legislators
  - Northern California E2 meetings held to expand volunteer network
  - Southern California E2 members hold many in district meetings with with crucial swing legislators
  - Developed E2 analysis showing up to 124% of the needed reductions in GWP were possible and cost effective.
  - Assist in refinement of AB 32 language with legislative leaders and the administration
- August 2006:
  - During August, E2 members hold 36 meetings with legislators
  - Developed E2 analysis showing how to cut 10% of GWP from transportation fuels.
  - Climate Week in the State Capitol – E2 helps organize press events, HBO film showing of *Too Hot not to Handle* and lobby days with small businesses, venture capitalists, mayors, water districts and religious community leaders, among others
  - E2 participates in press conference with Speaker and Ms. Pavley and frames the message: “Business community divided on AB 32”
  - E2 members bring in support from Republicans for Environmental Protection
  - SF Chamber, SVLG, Calpine, Waste Management and PG&E all register support for AB 32
  - Meeting number 124 with legislator is the final scheduled meeting of the campaign.
  - In final week, E2 drop-in meetings cover nearly every office inclined to support AB 32
  - In final week, E2 worked daily with Assembly, Senate and Governor's offices to keep AB 32 language strong
  - August 30 - Speaker Núñez and Pro tem Perata announce deal with Governor at press conference including E2. National and international coverage mentions E2.
  - August 30, 9:48 pm Senate approves AB 32, 23-14
  - August 31, 4:05 pm Assembly approves AB 32, 47-32
- September 2006:
  - September 27, Governor Schwarzenegger signs AB 32, E2 is credited for its leading role



## California Global Warming Solutions Act of 2006

Cutting pollution while strengthening the economy

The California Global Warming Solutions Act of 2006<sup>i</sup> (AB 32) calls for greenhouse gas reductions back to 1990 levels by the year 2020. E2 believes that this goal is achievable with available technology, and that the reductions will also spur a greater diversity of energy supplies and in some cases, lower costs for energy.

### Target Reductions

California's emissions in 1990 totaled 426 million metric tons of CO2 equivalent (MMT). Emissions rose to 475 by 2000 and, without the standards AB 32 calls for, are expected to reach 600 MMT by 2020. AB 32 requires a reduction of 174 MMT per year by 2020. This is the equivalent of the emissions from 43 coal-fired power plants.<sup>ii</sup>

The final report by the Schwarzenegger Administration's Climate Action Team<sup>iii</sup> identifies a collection of existing and future programs that collectively reduce 191 MMT per year. E2 has reviewed those and put them into 10 categories. In addition, three additional actions are identified that would produce an additional 22 MMT in reductions for a total of 213 MMT, or 124 percent, of the amount of reductions needed.

| Strategy                | CAT Reductions in 2020 | With Additional Opportunities | Percentage of 174 tons needed |
|-------------------------|------------------------|-------------------------------|-------------------------------|
| 1. Energy Efficiency    | 30                     | <b>34</b>                     | 20%                           |
| 2. Renewable Energy     | 17                     | 17                            | 10%                           |
| 3. Cleaner Power Plants | 16                     | 16                            | 9%                            |
| 4. Clean Cars           | 48                     | 48                            | 28%                           |
| 5. Renewable Fuels      | 4                      | <b>18</b>                     | 10%                           |
| 6. Smart Growth         | 27                     | 27                            | 16%                           |
| 7. Water Efficiency     | 1                      | <b>5</b>                      | 3%                            |
| 8. Forestry             | 35                     | 35                            | 20%                           |
| 9. Other                | 13                     | 13                            | 7%                            |
| 10. Innovation          | 0                      | 0                             | 0%                            |
| <b>TOTAL</b>            | <b>191</b>             | <b>213</b>                    | <b>124%</b>                   |

With an excess of 39 MMT, there is room for individual programs to fail to achieve their reductions without preventing California from meeting its overall target.

### Three Additional Opportunities

Updates from the Title 24 building standards and Title 20 appliance standards will save 4 MMT/year assuming the standards are proportional to the last updates and that they displace energy from efficient combined-cycle natural gas-fired power plants. An aggressive water use efficiency program would enable California to save approximately 5 million acre-feet by 2020, which is enough to meet the water supply needs of all the households in Los Angeles County.<sup>iv</sup> This in turn would cut global warming pollution by more than 5 MMT/year.<sup>v</sup>

Displacing 1.5 billion gallons of gasoline with 2.5 billion gallons of ethanol made from California sugar crops (cane, beets, sorghum) would save 17 MMT. Sugar-based ethanol is common in Brazil and emits one-tenth the greenhouse gas emissions of gasoline. 1 MMT can be saved through the use of bio-diesel.

## Impacts on Businesses and Consumers

E2 considers four main factors when looking at the business impacts of AB 32: energy pricing, energy availability, redirecting expenditures from outside California back into the state, and the growth of Cleantech businesses in California.

Of the 10 categories of reductions, energy efficiency, cleaner power plants, clean cars, smart growth and water efficiency all reduce demand for energy and, thus, help keep prices down. Renewable energy can compete on price with natural gas, but is only competitive with old, coal-based generation if the U.S. requires carbon capture on coal. (Twenty percent of California's electricity comes from coal.) In the timeframe of 2020, this seems likely. Biofuels can compete today with gasoline made from oil at \$40/barrel<sup>vi</sup> and can compete with diesel at \$60/barrel. In the 2020 timeframe, biofuels and electric vehicles will continue to put price pressure on fossil fuels.

By diversifying our energy sources we ensure better availability of energy and less dependency on the security risks associated with foreign oil. California currently spends \$30 billion/year purchasing fossil fuels from outside of California. Money diverted back to California for fuels derived from California companies will improve our economic well-being.

In 2005, 42 California Cleantech startup companies received \$484 million in venture capital.<sup>vii</sup> For every \$100 million in venture capital, 2,700 direct jobs are created during the life of the company.<sup>viii</sup> As with businesses in most other sectors, it is to the advantage of Cleantech companies to be located close to their markets. AB 32 will help ensure that California remains the largest market for clean energy and energy efficiency in the U.S.

## Innovation

Technical innovation is commonplace in California's business culture. While it is not possible to predict what innovations will occur in the next 15 years (examples in the last 15 years include digital cameras, DVDs, cell phones, GPS, Google, Amazon, eBay, etc), innovations may make it possible to produce energy from algae farms, advanced batteries for electric vehicles, solar at \$.05/kilowatt hour without subsidies, and bio-refineries to replace petro-refineries. Although new innovations are not accounted for in the analysis of reduction strategies, they could bring about substantial greenhouse gas reductions in addition to those listed above.

## Summary

To keep downward pressure on energy prices and keep energy dollars spent inside the state, California must encourage efficiency, renewables and innovation. AB 32, with its targeted reductions of global warming pollution, is the best legislative vehicle by which to put these changes in motion. Strategies that can produce 124 percent of the needed reductions to meet AB 32's targets have already been identified. With the addition of federal carbon constraints on coal-powered electricity, and innovations in Cleantech, renewables will bring a very strong challenge to traditional coal-based energy.

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<sup>i</sup> "[California Solutions for Global Warming](http://www.solutionsforglobalwarming.org/index.html)" - [www.solutionsforglobalwarming.org/index.html](http://www.solutionsforglobalwarming.org/index.html)

<sup>ii</sup> 500 MW plant operating at 85% capacity emitting 4 MMT/yr

<sup>iii</sup> [http://www.climatechange.ca.gov/climate\\_action\\_team/reports/index.html](http://www.climatechange.ca.gov/climate_action_team/reports/index.html)

<sup>iv</sup> Glieck, P. et al., *California Water 2030: An Efficient Future*, Pacific Institute for Studies in Development, Environment and Security, 2005.

<sup>v</sup> Assumes 1 million tons per 1 MAF, from page 50 of the CAT Report.

<sup>vi</sup> "[Replacing Gasoline with Biofuels](http://www.e2.org/ext/jsp/controller?docId=10022)" - [www.e2.org/ext/jsp/controller?docId=10022](http://www.e2.org/ext/jsp/controller?docId=10022)

<sup>vii</sup> "[California's Cleantech Industry](http://www.e2.org/ext/jsp/controller?docId=10020)" - [www.e2.org/ext/jsp/controller?docId=10020](http://www.e2.org/ext/jsp/controller?docId=10020)

<sup>viii</sup> "[Creating Cleantech Clusters](http://www.e2.org/ext/jsp/controller?docId=10462)" - [www.e2.org/ext/jsp/controller?docId=10462](http://www.e2.org/ext/jsp/controller?docId=10462)



## **Developing Low Carbon Ethanol For California** **How to cut 10 percent global warming pollution from gasoline**

The California Global Warming Solutions Act of 2006<sup>i</sup> (AB 32) calls for greenhouse gas reductions back to 1990 levels by the year 2020. E2 believes that this goal is achievable with available technology, and that the reductions will also spur a greater diversity of energy supplies and in some cases, lower costs for energy.

One important strategy is to displace gasoline with very low polluting biofuels made from feedstocks grown on California farms. Biofuels have the double benefit of both reducing greenhouse gases and keeping money that would otherwise buy crude oil overseas in California helping out own economy.

### **Making Ethanol – from corn to sugar to cellulosic feedstocks**

Ethanol in the U.S. is almost entirely made from corn today with a moderate reduction in global warming pollution as compared to gasoline. California producers are the most efficient in the U.S. in part because they do not use coal nor do they need to dry the “distillers grain”. Sugar feedstocks – sugar cane, sweet sorghum and sugar beets – are even more efficient and can produce ethanol with very little global warming pollution. In particular, sugar cane and sweet sorghum can produce both renewable ethanol and renewable electricity and are well suited to California agriculture. Cellulosic ethanol will be the lowest in greenhouse gases but production capacity is still in the future.

### **Global Warming Pollution From Gasoline**

On average, about 25 pounds of CO<sub>2</sub> are released for each gallon of gasoline (20 from the vehicle and 5 from the refinery process<sup>ii</sup>). California will use about 15 billion gallons of gasoline per year in 2020 for a total of 375 billion pounds of CO<sub>2</sub>. Converted to million metric tons (MMT), this would be 170 MMT. A ten percent reduction or 17 MMT would require replacing 1.5 billion gallons of gasoline with 2.5 billion gallons of ethanol. This assumes the ethanol is 90% free of carbon emissions and that it takes 1.5 gallons of ethanol to move a car the same distance as 1 gallon of gasoline. More ethanol is needed because it contains 33 percent less energy per volume than gasoline.

### **Producing 2.5 Billion Gallons of Low Carbon Ethanol**

When ethanol is made from sugar crops such as sugar cane or sweet sorghum it produces significantly less global warming pollution than when it is produced from corn because the fiber from the plant can be used to produce substantial amounts of heat and renewable electricity which can both power the bio-refinery and produce excess power for the grid. Approximately 500 kilo-watt-hours of excess electricity can be produced from a ton of dry fiber (for sugar cane, dry fiber constitutes about 27% of the biomass of the fresh crop). In an ethanol optimized production facility, only about 35% of the total electricity produced is needed to convert the sugar cane to ethanol. Thus sugar crops can be a significant source of both low carbon ethanol and renewable electricity, as demonstrated in Brazil and elsewhere.

### **Sugar Cane and Sweet Sorghum Examples**

California's Imperial Valley has excellent growing conditions for sugar cane – irrigated conditions that provide twice the yield per acre than achieved in Brazil. A University of California at Riverside study concluded that one acre of sugar cane can produce a minimum of about 1200 gallons of ethanol per season and a maximum of 2,100<sup>iii</sup>. Using the lower number, an acre produces:

1200 gallons of ethanol + 8.4 tons of fiber which can be converted into 4.2 Megawatt-hours electricity available to the grid (based on 50 tons/acre and 24 gallons ethanol/ton).

Sweet Sorghum can grow in many farming regions of California and produces a mature crop in only 4 months. In each 4 month cycle one acre of sweet sorghum produces:

600 gallons of ethanol + 8.4 tons of dry fiber which can be converted into 4.2 Megawatt-hours electricity.

### **Optimizing Energy Crops**

In the timeframe of 2020, four significant improvements are likely for increasing the yield per acre of cane and sorghum. First, crops can be selected to maximize their sugar and fiber content. For example, existing species of high-fiber cane can produce 40% more sugar and 2.5 times the fiber per acre than traditional cane used for making crystalline sugar. Second, companies have proposed changes to the fermentation process from sugar to alcohol which improve the yield by more than 50%<sup>iv</sup>. Third, in a ten year time frame, it can be expected that cellulosic ethanol will be able to cost-effectively produce 80 gallons of ethanol per dry ton of biomass. Fourth, electricity from fiber can be produced by gasification instead of combustion providing a 50% increase in the amount of electricity produced per dry ton of fiber or biomass.

Using a hi-fiber cane and assuming an improved fermentation process and increasing yield from 50 to 65 tons per acre, Imperial Valley sugar cane would produce per acre:

3,276 gallons of ethanol + 27.3 tons of fiber which can be converted into 13.65 Megawatt-hours electricity.

With an improved fermentation process sweet sorghum would increase to 900 gallons of ethanol per acre + 8.4 tons of fiber which can be converted into 4.2 Megawatt-hours electricity.

### **2020 Potential for California Grown, Low Carbon Fuel**

There may be up to 300,000 acres of land in California which can profitably grow sugar cane without an increase in water usage. We estimate that crops of sweet sorghum could be grown on 500,000 non-dedicated acres annually, throughout the state. In some cases, more than one crop of sweet sorghum would be grown per year but let us assume one crop. By 2020, 800,00 acres would annually produce:

1.43 billion gallons of ethanol + 6,195 Gigawatt-Hours of exportable, renewable electricity.

An additional 1.3 billion gallons of ethanol and 317 Gigawatt-Hours of power would come from conversion of 16 million dry tons of cellulosic material converted at the rate of 80 gallons/ton<sup>v</sup> and electricity at 24.4 Gigawatt-hour per 100M gallons.

### **Summary**

Sugar crop can be expected to start producing low carbon fuel in 100 million gallon quantities within 5 years. Improvements in the fermentation process and optimized crops can be expected in 6 – 10 years to produce about 1.5 billion gallons per year. Cellulosic ethanol can be expected to begin volume production in 6 years and be at the billion gallon level within 10 – 15 years. It is reasonable that production could be at 2.5 billion gallons/year by 2020 and displace enough gasoline to reduce global warming pollution by 17 MMT. Electricity production of 6,195 Gigawatt-hours represents about 2% of total expected demand in 2020<sup>vi</sup> and a 20% increase above our current renewable generation of 31,000 Gigawatt-hours.

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<sup>i</sup> "[California Solutions for Global Warming](http://www.solutionsforglobalwarming.org/index.html)" - www.solutionsforglobalwarming.org/index.html

<sup>ii</sup> Joe Romm - autos.groups.yahoo.com/group/calcars-news/message/65

<sup>iii</sup> "An Overview of the Feasibility of Establishing a Sugar Cane to Ethanol Industry in the Imperial Valley of California", Paul Sebesta, et. Al, The University of California Desert Research and Extension Center.

<sup>iv</sup> Zeachem - www.zeachem.com/tech.html

<sup>v</sup> Growing Energy: - www.nrdc.org/air/energy/pump/contents.asp

<sup>vi</sup> California Energy Demand Forecast 2006-2016 - CEC-400-2005-034-SF-ED2, September 2005