

The SF League of Women Voters, First in a Series of Events
Celebrating the Centennial of Women's Suffrage
The State of Climate Change
Mechanics Institute, 57 Post Street 10th Floor
Wednesday, May 19, 2010, 6:00-8:00 PM
Guest Speaker, Commissioner Ryan

Introduction

- ✚ I would like to thank Karen Clopton and the League of Women voters of San Francisco for inviting me to speak to you tonight.
- ✚ It is a great honor to open up this series of events celebrating the centennial of women's suffrage.
 - After a long struggle of women to earn the right to vote, California's voters finally granted women's suffrage in 1911.
 - We have come a long way since then!
 - We are still proud mothers, daughters, wives, and partners.
 - Today we also occupy many roles that were once reserved for men-- lawyers, judges, engineers, scientists, legislators, executives, construction workers, truck drivers, even PUC commissioners!
 - The next generation of women will continue this trend, breaking thru the remaining gender barriers.
- ✚ I also believe that women will be in the vanguard of tackling the most important environmental challenge of the 21st century: the global climate crisis.

✚ Developing and implementing policies to address climate change has become a major professional focus for me over the last decade.

- I was trained as an economist and focused from early in my career on energy policy.
- After moving to California for my graduate studies, I fell in love with the state's diverse environment and population. I decided to make my life and career here.
- Over time it became increasingly important to me to devote my professional skills to my personal passion for the environment.
- So I left my economic consulting job behind and went to work in the environmental movement.
 - Initially I focused on protecting California's rivers and watersheds.
 - As I came to better understand the many ways that global warming threatens our state and its people, I gravitated toward climate policy.
- When I got the chance to join the PUC's staff in 2006, helping to shape climate policy for California's energy industries was a one of my principal responsibilities.
- Now that I have been appointed a commissioner it continues to be a central focus for me.

✚ I'm pleased to share with you tonight my views on how my discipline, economics, can help us better understand and respond to the challenges of the climate crisis.

- The first step of understanding what is at stake and identifying solutions to overcome this problem is to educate ourselves.
- So I applaud the league for launching this educational series to help its members better understand this very momentous challenge of our time.

What is climate change crisis?

✚ Before we go any further, I would like to talk very briefly about what we mean by the global climate change crisis.

✚ The earth's climate is changing. In most places, average temperatures are rising.

- Scientists first observed this trend in the late 1800s, coinciding with the industrial revolution.
- Alarmingly, the pace of this warming has increased in recent decades.

✚ This warming is caused by rising concentrations of greenhouse gases in the Earth's atmosphere.

✚ Carbon Dioxide—CO₂—gets most of the ink, but it's only one of several greenhouse gases.

- Other important greenhouse gases include water vapor, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.
 - Some of these are far more potent than CO₂, with warming potential per unit of volume tens or even hundreds of times higher than for CO₂.
- ✚ Most human activities release “greenhouse gases” into the atmosphere.
- Much of the attention focuses on emissions from burning of fossil fuels -- coal, natural gas and petroleum based products.
 - Deforestation has also contributed to rising concentrations of heat-trapping greenhouse gases in our atmosphere.
 - Live stock operations and landfills release immense volumes of methane, which is 20 times more potent than CO₂.
- ✚ The one thing all of the greenhouse gases have in common is that they prevent heat from escaping to space, somewhat like the glass panels in a greenhouse. -- The term greenhouse gas comes from this analogy.

- ✚ If we continue today's business-as-usual trend, scientists predict that average temperatures will be about 9 degrees Fahrenheit higher in 2100 than they were in 2000.
- This will have a devastating effect on ecosystems around the globe.
 - Precipitation patterns will change, with some regions getting much wetter and others much drier.
 - Sea levels would rise. Storms and coastal flooding, already a major source of natural disasters, would become more frequent and severe.
 - All countries will be affected.
 - The poorest countries and populations will suffer earliest and most severely.
 - Drought and disrupted water supplies are projected to have profound affects on agriculture and food production.
 - Africa is expected to be especially hard hit.
 - Ironically—and sadly--these people have contributed least to the causes of climate change. And they have the least resources to adapt to it.
 - Deserts would expand and the melting of the polar ice caps and the glaciers in the Andes and Himalayas would accelerate.

- Thousands of species would be in danger of disappearing.

✚ To me and many others, the prospect of these dire outcomes call for urgent actions to reduce emissions, save our economy, and preserve our planet for generations to come. Any delays will make the problem much worse and more costly.

- So far I have offered a very simplified version of what we are hearing from the mainstream scientific community about climate change.
 - Science helps us understand the physical processes that underlie the problem of climate change.
 - Science helps us understand how human activities are contributing to this phenomenon.
 - And science also helps us envision the consequences of unchecked climate change.
 - Technology is widely viewed as the source of the solution—or, more realistically, solutions—to climate change.
- People tend to look to my discipline, economics, to answer just one question: how much is all of this going to cost?
- I think Economics actually informs many other aspects of the climate change problem.

- Economics provides insights into the root causes of climate change, from a behavioral perspective instead of a physical one.
- Economics also points the ways to policies that can both discourage activities that contribute to the problem and promote activities that contribute to the solution.
- Economics helps us decide which policies to use and how far to push them.
- And it also can answer the question of how much do the remedies cost and do their benefits outweigh their costs.

I would now like to walk you through each of these areas, and offer you a window into how economists think about the climate crisis and policies to address it.

What is climate change crisis from an economist's point of view?

- ✚ Greenhouse gas emissions are a classic example of what economists call a negative externality.
 - What is an externality?
 - Standard economic theory states that any voluntary exchange is mutually beneficial to both parties involved in the trade. However, an exchange can cause adverse impacts on third parties who are not part of that transaction.
 - Negative externalities are literally all around us—
 - Smog;

- Litter;
- Polluted storm run-off;
- Noise and dust from construction sites.
- From an economist's perspective the fundamental problem is one of missing markets or incomplete prices.
 - For example, the price of gasoline at the pump does not factor in the cost to others of the pollution generated when I drive my car.
 - If the full social cost of driving my car was factored into the price of gasoline, I might not drive as much or I might choose a more fuel efficient car.
- ✚ Negative externalities are an important class of what economists call market failures. When a product or an industry exhibits a market failure voluntary transactions will not yield socially optimal outcomes.
- ✚ Much of the field of Environmental economics focuses on diagnosing and addressing negative externalities.
- ✚ In words of British Economist Sir Nicolas Stern, "Climate change is the greatest market failure the world has ever seen."
- ✚ According to Stern, climate change has a number of features that together distinguish it from other externalities.
 - It is global in its causes and consequences;

- The impacts of climate change are persistent and develop over the long run;
- There are uncertainties that prevent precise quantification of the economic impacts;
- There is a serious risk of major, irreversible change with significant economic effects.
- This is not your garden variety market failure! Analyzing climate change has really challenged economists.

How should we deal with climate change crisis?

- ✚ There are two broad classes of policy tools for dealing with environmental externalities:
 - One is command and control: Government can impose rules or at least limit behaviors that impose high costs on others.
 - In the first wave of automotive air quality regulations in the U.S, automakers were required to install air pollution control equipment on new cars. An example was catalytic converters.
 - Fuel efficiency standards are another type of government mandate. Here the regulator sets a target and lets companies decide how to meet it.
 - The other major class of policies are market based measures. The goal of these policies is to reduce or eliminate the incentive to engage in harmful activities

by factoring their cost into the price of the underlying good. If consumers must bear the full social cost of their choices, they will take the effects on others into account when they decide how much to make or use of something.

- Emission taxes are the most direct approach. In the GHG context this could take the form of a tax on the carbon content of fuels.
- The Canadian province of British Columbia has adopted a carbon tax, and have some European nations.
- ✚ The other major category of market based policies are tradable permit systems – Cap and trade. Instead of directly setting a price on GHG emissions, the government sets a binding limit on the total amount of GHGs that may be emitted.
- ✚ Within this quantity ceiling, entities covered by the system – such as firms, countries or individuals – are free to choose how best – and where – to deliver emission reductions within the system.
- ✚ The largest example of cap-and-trade system for greenhouse gases is the European Union's Emission Trading Scheme. Cap and trade has also been a central feature of virtually all of the climate policy bills that have been introduced in the US Congress. C & T has also

been used successfully in the US to reduce smog forming gases and SO₂, the chemical that causes acid rain

- ✚ Economists tend to favor market-based systems for a couple of reasons.
 - ▶ First these measures directly address the underlying problem of unpriced externalities and skewed incentives.
 - ▶ Second, and perhaps more important, market based approaches are not prescriptive. It is up to the individual consumer or firm to find the least cost way to comply. There is also an incentive for innovation. Over time the overall cost to society will most likely be lower than it would be under a command and control approach.

- ✚ Let me turn now to the final major area in which economics sheds important light on the climate crisis. This is the question of measuring and weighing the costs and benefits of climate policies.
 - Actions for mitigating climate change will require massive investments over a sustained period.
 - Adapting to climate change is another option. It will also be costly, and there are choices to be made between alternative adaptation strategies.
 - Inaction has a price-tag too.

- ✚ There will be adverse impacts on people, the built environment, the economy and the natural environment. These need to be measured to the extent feasible and factored into a proper accounting.
- ✚ The status quo – what economists call the baseline – is a moving target. Things will not stay the same if we do nothing
 - There are other costs to climate change policies like vanishing species and human suffering from hunger, disease and dislocations. These are the most speculative and difficult to measure, but they should be included in a thorough accounting.
- ✚ How do we weigh the costs of such measures against the benefits they may yield?
 - Cost benefit analysis and a closely related tool, cost effectiveness analysis, provide one framework.
 - The good news is that over the years economists have devised a whole arsenal of tools to quantify and value even the most intangible costs.
 - The bad news is that the climate crisis is global in scope, spans most human activities, is unfolding over centuries and is subject to major uncertainties. Remember these were some of the reasons Sir Nicholas Stern

characterized it as the “greatest market failure the world has ever seen.”

- Cost Benefit analysis is most commonly used to examine individual infrastructure projects or public programs:

- ✚ Should the Bay Bridge be retrofitted or replaced?

- ✚ Should California invest in high-speed rail?

- ✚ Does Three Strikes cost money or save money.

- ✚ These are reasonably well contained questions with a finite time-span.

- ✚ Efforts to conduct a comprehensive cost-benefit analysis of an overall strategy to addressing climate change face serious challenges.

- Economists have responded to this challenge in a few ways.

- One approach is to peel off parts of the problem, to examine the cost effectiveness of individual measures:

- ✚ Cost effectiveness asks a relatively simple question: of the measures available to achieve a given result, which is or are the cheapest?

- ✚ For example, it is the PUC’s policy to authorize the utilities to invest ratepayer funds in all cost effective energy efficiency measures.

- Measures are considered cost effective if their cost is less than the value of the energy they save.
- ✚ The California Air Resources Board followed a cost effectiveness framework when it set standards for tailpipe emissions from passenger vehicles.
 - The level of the standard was set so that reduced operating costs of vehicles—mostly lower gas usage—would more than offset the projected increase in new car prices.
- ✚ Economists have also conducted comprehensive cost benefit analyses to assess whether the benefits of an aggressive overall mitigation policy outweighs the costs over time.
 - These studies tend to rely on large scale macroeconomic models of an entire economy—a state, a country or the entire world.
 - The analyst factors in the cost of a carbon tax or cap and trade and other sector specific policies.
- ✚ The model then tells us how important economic indicators like economic growth, industrial output and employment will respond over time.
- ✚ An example of such studies is Britain's 2006 Stern Review. A team of UK Treasury economists led by Sir Nicholas Stern concluded that the costs of stabilizing the rate of climate

change will be significant but manageable; delay would be dangerous and much more costly.

- ✚ In conducting such studies the analyst must make many assumptions and other difficult choices in configuring these models.
 - Chief among them is the choice of a parameter called the discount rate.
 - The discount rate captures the natural human tendency to prefer consumption today over consumption tomorrow.
 - ✚ Discount rates commonly used in cost benefit analyses tend to reflect a relatively short time horizon, or more simply put, a relatively strong preference for current consumption.
 - ✚ This convention presents a problem when we study programs to address climate change. Any discount rate much above zero has the affect of rendering irrelevant the policy's impacts on future generations. For example, at a discount rate as low as 3%, a dollar received or lost a century from now is valued at only a nickel today.
- ✚ Stern regarded this outcome as unethical, and used a discount rate barely above zero. Many economists have been critical of Stern's analysis for this reason. Others are supportive.

- ▶ Stern's critics contend that he should have used higher rates, consistent with real interest rates seen in today's marketplace -- short-term rates, like 3%.
- ▶ Others argue for the very long term rate, such as 40-year, British government bond rate of .5% real rate. Stern's choice of discount rate is more consistent with this point of view.
- ▶ This debate is not just a bunch of academics arguing an arcane matter of inside Baseball. The choice of discount rate drives major differences in conclusions about whether or not it is in society's interest to invest in mitigating climate change.
- ▶ Martin Weitzman, an economic professor at Harvard University, argues that Stern got the right answer, but for a different reason.
- ▶ He suggests that instead of justifying a very low discount rate we should reframe the question.
- ▶ Scientists tell us that there is a chance, whose subjective probability is small but diffuse, that global warming may eventually cause disastrous and environmental catastrophes.
- ▶ Weitzman contends that the risk of such a global catastrophe warrants investing in insurance against such an eventuality.

- ▶ The insurance policy takes the form of investments in climate mitigation and adaptation strategies.

✚ Weitzman's analogy makes sense to me.

- ▶ We still need to try to project and place a price-tag on the consequences of climate change.
- ▶ Economists would still use macroeconomic models to gauge the effects of climate policies on growth and other key indicators.
- ▶ But we would weigh their findings in a different way.
- ▶ The question then becomes are we willing to accept somewhat slower growth today in order to avoid the worst possible outcomes from climate change.

✚ If the majority of scientists are warning us that we may face truly disastrous effects from the climate change crisis and we have an opportunity to mitigate the crisis, being 2% or 3% richer today may not be all we want to concentrate on.

✚ So we may view the investments we are making today as insurance for the future of generations to come and saving our planet.

What have we done in California and in the Commission?

✚ Now I will offer a brief overview of California's climate policies, emphasizing the electric sector. I will also point out

the ways that these policies embody the economic principles and apply the methods that I've just laid out for you.

✚ I am proud to say that I represent an organization and a state that have been on the forefront of progressive environmental and energy policies to meet the challenge of the global climate crisis.

- ▶ We should not underestimate the impact of our energy policies.
- ▶ California's economy is the largest of any state in the US, and depending on how the dollar is trading against the Euro somewhere between the fifth and the eighth largest economy in the world.
- ▶ If California was an independent country, we would be somewhere between the ninth and sixteenth largest emitter in the world, depending on the year.
- ▶ Over the last several years I have travelled widely and met with numerous foreign delegations to discuss California's climate and energy policies.
- ▶ When it comes to climate and energy policy, California is a highly respected and influential player on the world stage.

✚ For more than thirty years, California has had aggressive energy efficiency and renewable energy policies.

- ▶ In the last decade we have also added ambitious greenhouse gas reduction strategies.

- ▶ We have also begun to develop strategies to adapt to the inevitable climate change that is already occurring.
- ▶ And we expanded our clean energy strategies and have reframed them as greenhouse gas reduction strategies.

AB 32

✚ The single most important step that California has taken was the California Global Warming Solutions Act of 2006, also known as Assembly Bill 32 or simply AB32.

- ▶ This landmark climate legislation for the first time commits the state to binding GHG emission reduction targets.

- ▶ In the U.S. this was an unprecedented step.

- ▶ AB32 requires California to reduce its overall GHG emissions:

- to 1990 levels by 2020 and
- to 80% below 1990 levels by 2050

- The cap first goes into effect in 2012 and then ratchets down over time.

- ▶ AB32 directs CARB to employ cost-effective strategies to meet these targets.

- ▶ AB32 also required the California Air Resources Board (CARB) to coordinate with other public agencies in

developing a comprehensive roadmap to meet the 2020 emissions reductions target.

✚ In December 2008, the Air Resources Board (ARB) adopted a final scoping plan which identified the various strategies that will be used to meet the emission reduction goals.

▶ My agency worked closely with CARB to develop parts of the scoping plan that touch on the electric and natural gas industries.

▶ As a senior staffer I was deeply involved in this effort, working side by side with my counterparts at half a dozen state agencies.

✚ CARB is now developing regulations to implement the scoping plan beginning in 2012.

✚ An important feature of CARB's AB32 Scoping plan is that it combines both market based measures and conventional regulatory mandates.

- CARB proposes to obtain approximately 80% of the required reductions from mandatory measures.
- The remaining 20% of reductions would be realized via a regional cap and trade program.
 - The scope cap and trade program would expand over time.
 - Eventually sectors accounting for over 80% of California's emissions will be included in the market.

- ✚ Most of the plan focuses on achieving reductions in the transportation and electric and natural gas sectors.
 - ▶ To a large extent the plan encompasses ongoing clean energy policies, although some are expected to expand over this decade. These take the form of conventional regulatory mandates.
 - ▶ What is new — and important -- is that the electricity and natural gas sectors would participate in the cap and trade program.
 - Even though the energy efficiency and renewable energy mandates came first, from a policy perspective I think it makes sense to regard cap and trade as the foundation.
- ✚ If you step back and think about it, there are really three principal sets of actions that can be taken to reduce GHG emissions from the energy sector.
 - ▶ We can use less energy
 - ▶ We can choose cleaner sources of energy
 - ▶ And we can invest in developing new clean technologies.
 - ▶ Putting a price on GHG emissions, as the cap and trade program will do, provides a market-based incentive to do each of these three things.
- ✚ Overlaying additional mandatory measures provides a means to address additional market failures which can impede emissions reductions, even if consumers and businesses see energy prices that reflect their true social cost.

▶ A key area where this is the case is energy efficiency. It is still the case that the cheapest kilowatt of electricity is the one you don't use.

- For over three decades California policy-makers have recognized that lack of information and other barriers have kept Californians from taking full advantage of this resource.
- It has been the state's policy to invest heavily in subsidizing energy efficiency — not just to prevent emissions of GHGs and other air pollutants, but also to save customers' money.

✚ These investments in energy efficiency programs and more efficient buildings and appliances have saved Californians billions on their utility bills.

- ▶ Over the last thirty years California has held its per capita energy consumption flat, even as our economy has grown and living standards have risen.
- ▶ Meanwhile per capita energy consumption for the entire United States has risen by 50%
- ▶ Had the US matched California's record over the last 30 years, we could have avoided building 500 large (500 MW) power plants - nearly a quarter of current US generating capacity.
- ▶ For this reason energy efficiency remains the highest priority resource in California. Our policy is to first achieve all cost-effective energy efficiency before investing in new power plants.

- ▶ The PUC recently adopted a Long Term Energy Efficiency Strategic Plan. It sets several ambitious long term goals for energy efficiency, including:
 - Making all new homes zero net energy by 2020,
 - making all new commercial construction zero net energy by 2030,
 - optimizing the performance of Heating Ventilation and Air Condition Systems for California's climate, and
 - ensuring that all low income households are given access to energy efficiency measures.

✚ CARB's scoping plan recognizes the critical contribution of energy efficiency to reducing the state's emissions footprint.

- ▶ Energy efficiency measures are anticipated to produce roughly 15% of the total reductions required to realize the 2020 goal, second only to efforts to reduce emissions from vehicles.
- ▶ These measures include dramatically increasing the efficiency of our buildings and appliances, deployment of combined heat and power systems and the rollout of significant amounts of solar hot water heating systems.

- ✚ Promoting investment in renewable energy has also been a policy priority in California for many years.
 - ▶ Subsidies and now mandatory procurement targets — the renewable portfolio standard — have helped commercialize new clean energy technologies.
 - ▶ California currently requires that 20% of delivered energy come from renewable sources, and the target will likely soon be raised to 33% by 2020.
- ✚ Legislation to increase the RPS is currently being considered in Sacramento.
 - ▶ And the CARB scoping plan calls for an expanded RPS, increasing the target from the current 20% to a 33% target.
 - ▶ This is anticipated to yield emission reductions of 21.3 MMTCOe, or about 13% of the emission reductions required by 2020.
- ✚ Clean renewable energy represents the second tier in California's hierarchy of energy resources. Enabling high penetration of a variety of renewable energy resources is a high priority. Wind farms, solar power, geothermal plants and biogas projects are among the new wave of generating facilities being developed in California.
- ✚ Even with aggressive investment in energy efficiency and renewable energy there will still be a need for conventional fossil power plants in the foreseeable future.

- ▶ Therefore a third priority is to ensure that inefficient, dirtier fossil-fired plants are phased out and that the next generation of these plants is as clean and efficient as possible.
 - ▶ Indeed California may even be the first place to demonstrate at utility scale the feasibility of capturing CO₂ from power plant emissions and permanently storing them underground in stable geologic formations.
 - ▶ Again, placing a price on carbon via cap and trade makes such investments more attractive than they would otherwise be. But this new technology needs an additional push to move from the lab to commercial operation.
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- Finally I would like to touch on one other area of energy policy that is a very important complement to the programs I've just outlined. That is California's investment in the Smart Grid.
 - Fundamentally smart grid refers to modernizing the electrical grid. A key element of this upgrade is incorporation of sensors and two-way communication technology into the grid.
 - From a customer perspective the visible manifestation of this transformation is the installation of a smart meter at their home.
 - There are also many less apparent upstream changes the electricity transmission and distribution system that will improve service reliability and enhance efficiency. The latter should lower costs to consumers.

- ✚ Once deployed, this technology will unleash a wave of innovation that will allow customers to better understand how they use energy and what they can do to reduce their bills and the environmental impact of their energy use.
- ✚ Giving customers better information should help break down some of the barriers to realizing all cost-effective energy efficiency.
- ✚ Customers will also have the opportunity to lower their bills by shifting energy to off-peak times. They will also have the opportunity to save money and reduce GHG emissions by participating in automated demand response programs.
 - Small changes in thermostat settings or simply delaying the defrost cycle on refrigerators can add up to big savings across thousands of households.
 - These can help shave demand on hot days when the grid is stressed and the dirtiest, most inefficient plants are running. They can also smooth out the profiles of intermittent wind and solar resources, helping to integrate larger amounts of clean energy into the grid.

Conclusion

- ✚ In closing I once again would like to applaud the League of Women Voters for embarking on this effort to better understand the issue of climate change.

- I believe that the Climate crisis is the greatest environmental challenge of our time.
- I also believe that it's imperative that we take bold and immediate action to address this challenge.
- However, I did not come here tonight to win anyone over to my point of view.

✚ I hope, instead, that my remarks have helped open one window into the vitally important perspective on the topic of climate change.

- In particular, I hope that I have succeeded in showing you how valuable the discipline of economics can be in helping to interpret the scientific evidence and weigh the many technological solutions before us.

✚ Economics shines a light on the fundamental incentive problems that result in the emissions causing global warming.

✚ Understanding global warming from this behavioral perspective provides insight into the choice and design of regulations to mitigate emissions.

- I believe the climate and energy policies that we are pursuing in California are well grounded in these principles.

✚ Finally, while economists' models can't tell us what policies we should chose, they can and should inform our choices. The

types of analyses I described in my remarks are in wide use in California and elsewhere today.

- ✚ I look forward to hearing from my esteemed colleague, Karen Clopton, about the progress of your climate change study.
 - The topic you have chosen is both complex and compelling.
 - I'm sure the conclusions you reach will be thoughtful and well-informed.
- ✚ Thank you and I would be happy to take some questions if time permits.