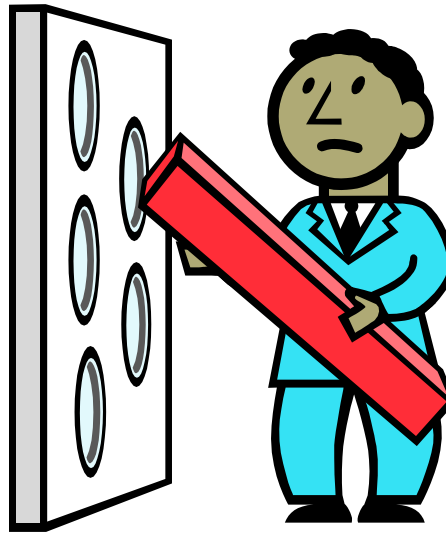


Square pegs and round holes

A history of earthquake insurance in California and a look towards the future



Overview of talk

1. History of California earthquakes with specific focus on those with an impact on insurance
2. The post Northridge world – impacts on both insurers and insureds
3. The challenges of writing EQ insurance
4. How the CEA addresses those challenges
5. What does the future hold?

History of California EQs

- 1906 San Francisco Earthquake – Although the earthquake peril was excluded from most policies, fire was not, and some estimates say fire accounted for as much as 80% of the damage.
- Fire losses from the 1906 S.F. EQ were approximately \$500 million of which 40% or \$235 million (almost \$6B in today's dollars) was insured.
- However, only \$180 million was actually paid as 14 insurers went bankrupt.

California EQs

- 1925 Santa Barbara EQ – Magnitude 6.3, first building codes addressing seismic risk followed
- 1933 Long Beach EQ – Mag. 6.25, Field Act (1933) subsequently passed requiring seismic standards for new school construction, Riley Act (1933) required all cities and counties to establish departments to regulate building construction. Garrison Act (1939) applied Field Act standards to existing schools.

California EQs continued

- 9 EQs from the 1971 San Fernando, 6.6 mag. to the 1989 6.9 mag. Loma Prieta EQ resulted in the passage of 58 laws for improvements of building and safety standards.
- None of these EQs, even Loma Prieta (\$1.9B insured loss in today's dollars) were a significant loss event

EQs that affected insurance

1983: Coalinga Earthquake

Until legislative action effective in 1985, judicial interpretations of concurrent causation required homeowners policies to cover earthquake losses, though expressly excluded.



1985: A new Mandatory Offer Law

Insurance Code, Chapter 8.5 (“Earthquake Insurance”), Sections 10081 *et seq.*

New law effectively excluded coverage of the peril of earthquake through operation of concurrent causation in a standard HO policy.

But the same law required an offer of earthquake insurance for the first time, to allow policyholders an opportunity to purchase quake coverage.



1985: Mandatory Offer Law

The California Department of Insurance cautioned that over time, the exposure presented by this risk might exceed insurers' ability to provide it.

Insurers said they were willing to take that risk if they were able to collect an appropriate premium for the earthquake risk, something they were effectively unable to do under concurrent causation.



1994: Northridge Earthquake



Total Property Damage: \$40 Billion

- Residential Damage: \$20 Billion
- Insured Residential Damage: \$8.4 to \$12.5 Billion (depending on who you ask, 1994 dollars, \$13.4 to 19.9B in today's dollars)

Déjà vu all over again

- Amount paid in claims was approximately 100 times the premium collected that year.
- The losses wiped out the industry's profit for the prior 47 years
- Insurers subsequently raised rates by 10-25% while others restricted the policies they would write
- What earthquake?

Déjà vu but with a different result

- Amount paid in claims was four times more than the EQ premium collected in the previous 25 years.
- Insurers subsequently raised rates and restricted the policies they would write
- What earthquake?
- Same result?

Northridge Immediately Stressed the Insurance Industry



Unanticipated large losses:
Insurers paid out losses far greater
than projected.

HO insurers were over-exposed: Insurers
had significant surplus reductions and
experienced rating-agency downgrades.



1995



**95% of HO voluntary market
restricted the selling of policies.**

1995



**California's
Earthquake-Insurance Market
was broken.**

1995



Industry unsuccessfully sought
repeal of mandatory offer law.

1995: First Attempt



AB 1366

Redefined earthquake coverage to focus on rebuilding structure and replacing or repairing bare necessities.

1996: “Mini Policy” Established

AB 1366: Mini Policy codified to satisfy Mandatory Offer.

- Dwelling structure – Limited
- Contents - \$5,000
- Additional living expense - \$1,500
- Deductible – 15%
- Other structure coverage essentially eliminated



1996: Market Remained Broken

The “mini policy”
slashed coverage in
half.



Companies were filing for
rate increases of 100% or
more.

But insurers continued to restrict writing homeowners policies.

1996: Second Attempt

The California Earthquake Authority was established – a publicly managed, privately funded, not-for-profit insurance enterprise formed to offer residential earthquake insurance.



Privately Financed



Armed Forces Insurance
OUR MISSION IS YOU.®



**California
FAIR
Plan** PROPERTY
INSURANCE



**Golden Eagle
Insurance**
Member of Liberty Mutual Group



**Liberty
Mutual**™



FARMERS



Allstate®
You're in good hands.



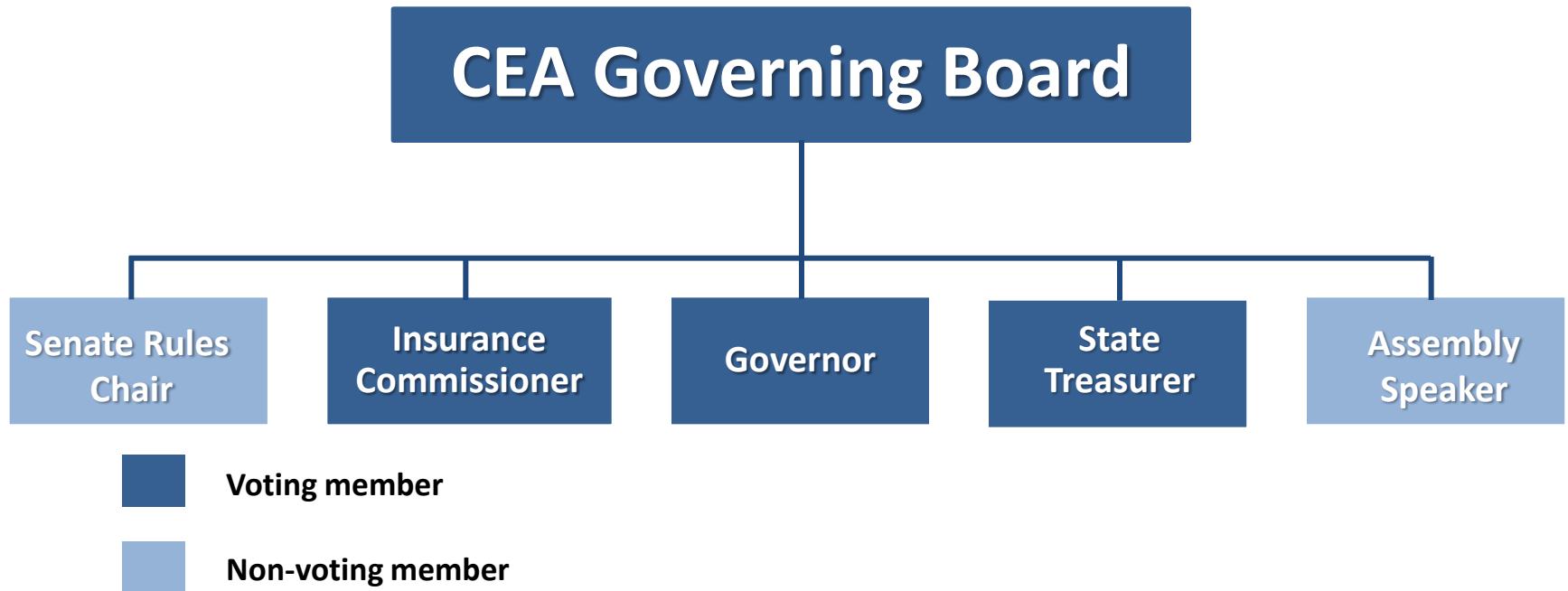
Encompass™
Creating protection around you



a Nationwide Insurance® company



Publicly managed





Today

840,000 Policies

3/4 of EQ policies in California

Largest EQ writer in U.S.

1997 Capital



\$630 M

2014 Capital



\$4.5 B

2014 Claim-Paying Capacity



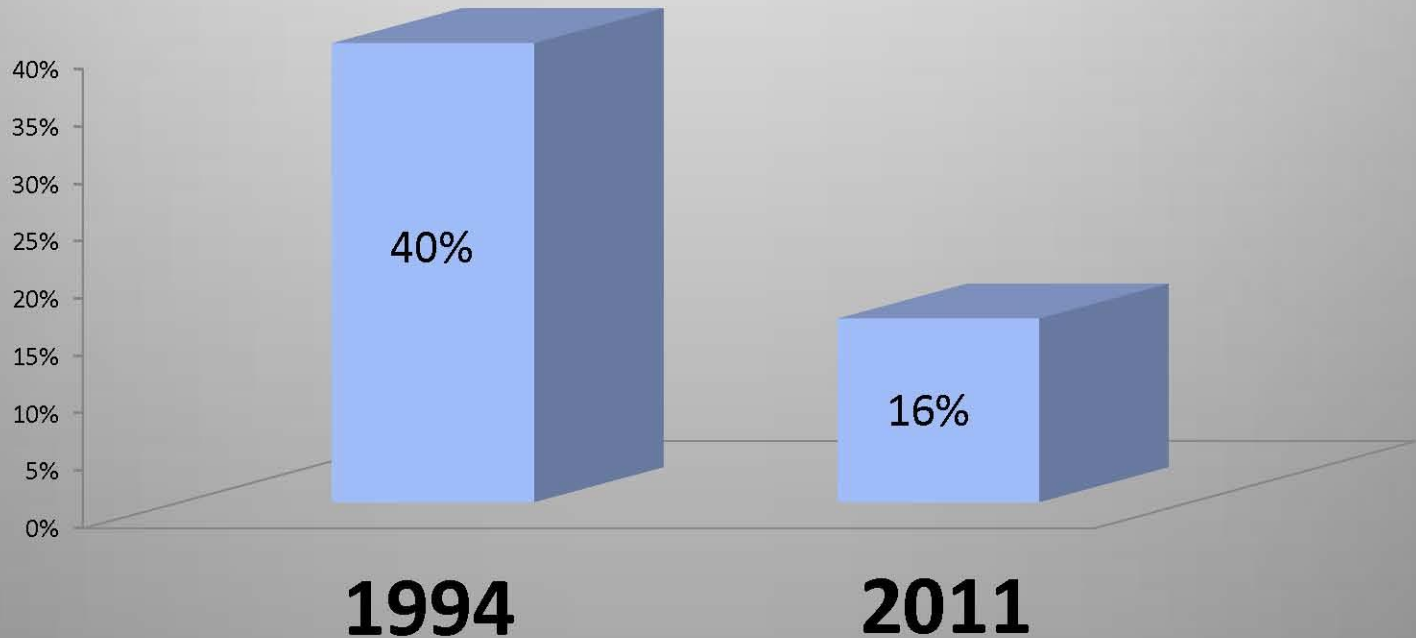
\$10.3 B

Northridge aftermath

- Although the homeowner's market was stabilized and insurers' surplus protected from the earthquake hazard the number of homeowners protected by residential earthquake insurance dropped dramatically, a condition that still exists today.
- Did the insurance marketplace overreact? Why did the market keep writing after 1906 but not 1994?

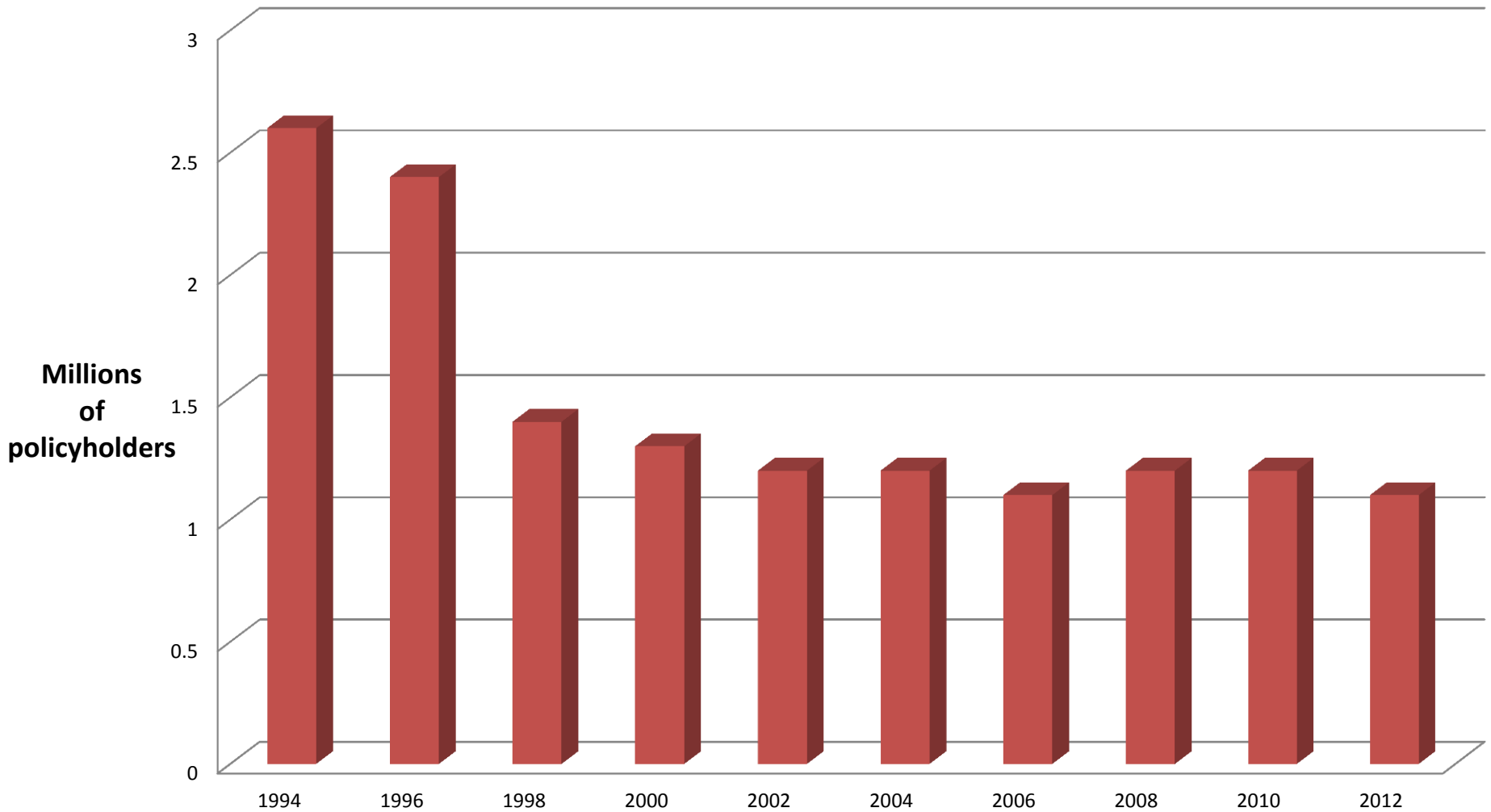
Insurance protection has fallen dramatically over the last two decades

Northridge Take-Up Rate



EQ Insurance Take-Up in California

One million policies lost in 2 years



Source: California Department of Insurance

Earthquake insurance take-up rates

Statewide Average

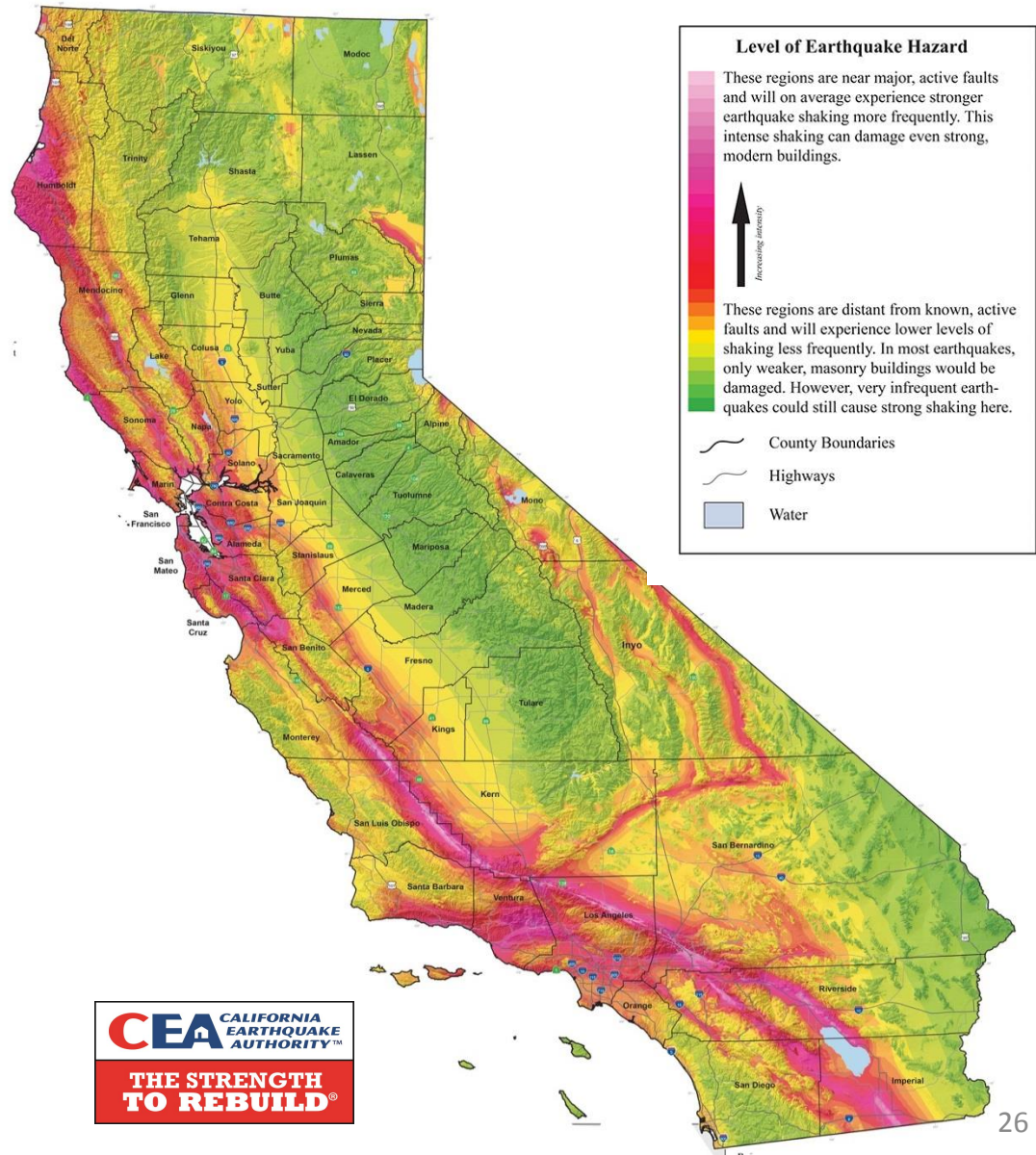
2011 11%

1994 29.8%

Counties: Today/1994

Sacramento	2.3%	8.6%
Alameda	10.2%	43.2%
San Francisco	9.4%	35.5%
San Mateo	10.3%	45.7%
Santa Clara	10.8%	46.5%
Santa Cruz	13.1%	42.2%
Kern	9.9%	22.7%
Los Angeles	16.6%	36.4%
Orange	17.7%	37.8%
San Diego	16.2%	24.9%

Source: 2011 and 1995 CDI Data
Dwellings only



The Challenge of writing EQ insurance: 1. Timing risk



- Timing risk is the risk that losses will occur too soon before enough premium is collected to cover them
- After Northridge many argued that earthquake was “uninsurable” let’s look at the ensuing 20 years and see if the answer would be the same

California Earthquake Premiums 1968 to 1994

1968	\$5,235,043	1982	\$ 58,877,353
1969	\$5,803,067	1983	\$ 70,447,511
1970	\$5,873,033	1984	\$ 79,451,808
1971	\$4,617,963	1985	\$132,871,355
1972	\$8,594,408	1986	\$180,034,484
1973	\$10,897,163	1987	\$208,376,248
1974	\$12,966,306	1988	\$277,816,956
1975	\$13,841,591	1989	\$333,597,666
1976	\$17,130,433	1990	\$384,641,615
1977	\$19,759,536	1991	\$427,398,658
1978	\$23,158,724	1992	\$479,969,102
1979	\$28,968,085	1993	\$520,960,123
1980	\$38,540,205	1994	\$550,000,000
1981	\$50,207,836		

Prepared by Personal Insurance Federation of California

Same data, different interpretations

- Does this example show that the EQ risk is uninsurable? After all it shows that the Northridge losses were four times the premium collected in the last 25 years
- Of course it is also true that exposure was rapidly growing during this time period but...
- Was it an example of timing risk? (see next slide)

California Earthquake Authority Premium and Losses - 1996 to 2013

- Premium collected \$7.81 billion
- Losses paid \$4.3 million
- Current ability to pay another Northridge, twice



Next Challenge: 2. Correlated losses

- The law of large numbers does not help/apply.
- In other words the standard deviation of the average amount of claim does not decrease as the number of claims increases **and** the claims are not independent as they happen in the same event.
- This in turn requires more capital so that the insurer can pay all of the losses.

Next challenge: 3. Uncertainty, variability in the loss

- Insurers must use models rather than historical experience to project the loss.
- Because the EQ loss is characterized by low frequency but high severity without an ability to validate model output from historical losses there can be significant variability in the actual results.

Model uncertainty

- The latest model UCERF3 is considerably more complex. UCERF2 has 480 logic tree branches, UCERF3 has 20,000.
- UCERF2 had 7 to 8,000 fault ruptures, UCERF3 has over 200,000.
- All of this demonstrate the increasing complexity involved in trying to model the losses.

Hypothetical

- Assume that a \$20B EQ will occur randomly once every 20 years. In order to pay the loss the insurer must hold the full \$20B in capital each year. Assume a 10% cost of capital. The insurer's cost of capital is therefore \$2B per year. Therefore, excluding expenses the insurer must charge \$3B a year for a \$1B expected loss.

Why Catastrophe Insurance is So Much More Expensive Than Other Insurance Lines

Challenges of the catastrophe line:

- Low frequency +
- High Severity +
- Correlated Losses +
- Timing Risk +
- Significant Variability =

HIGHER CAPITAL COSTS

Even reinsurers who make a living out of diversifying its covered perils worldwide to lower risks sometimes must charge premiums ten times or more than the expected loss covered by that premium. (See “Managing Large-Scale Risks in a New Era of Catastrophes,” Wharton Risk Management and Decision Processes Center, March 2008, at p. vii.)

Large writer’s data taken from public filings with Calif. Dept. of Insurance

Comparison of CEA Capital and Capital Charge to a Similarly Sized Large Personal Auto writer in California

		CEA	Large writer scaled to CEA	CEA / LW-scaled
1	Premium	556,389,000	556,389,000	1.00
2	Expected Losses	269,439,000	363,473,975	0.74
3	Underwriting Expenses	102,604,000	186,770,619	0.55
4	Capital Need	9,698,207,000	278,194,500	34.86
5	Capital Charge	184,346,000	5,563,890	33.13

Conclusion: Due to these significant challenges in the catastrophe line CEA rates must include a capital charge that is over 30 times that contained in the large writer’s personal auto rates. As a result, earthquake rates are 50% higher than they would be if capital needs were comparable to auto insurance.

To maintain financial strength, CEA must spend heavily on reinsurance

Rating Agencies:

- Target 1-in-500 year capacity

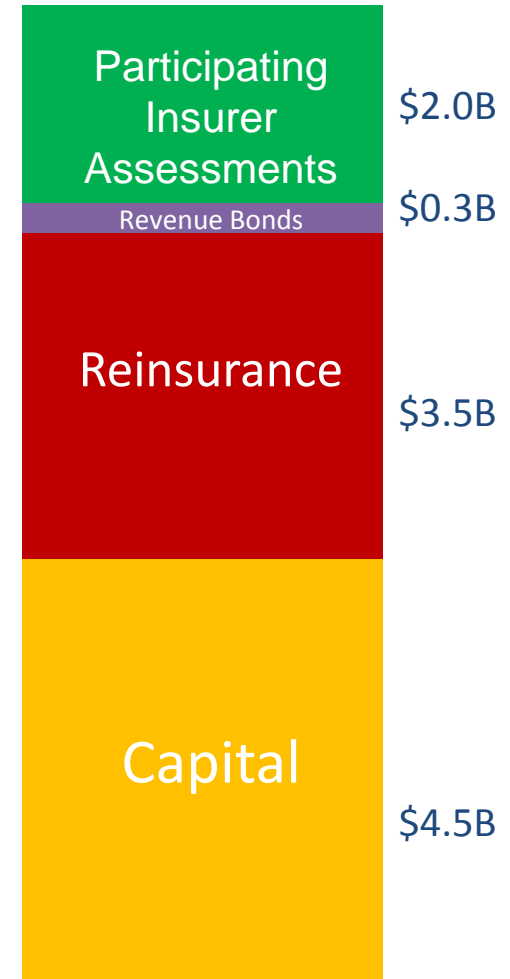
Reinsurance:

- **Costs CEA \$225(+) Million each year**
- Comprises 2/3 of CEA's overall expenses
- Absorbs 40% of policyholder premium

Costs borne by consumers:

- Expensive premium
- High deductible

Projected
2014 CEA Financial Structure



Total \$10.3 B



CEA: 5th Largest Buyer of Nat Cat Reinsurance in the World

20 largest XoL cat reinsurance buyers*

Rank	Cedant	Limit	Bought	Broker (s)	Geography	Comment
1	Zenkyoren	\$7.1bn	\$8.4bn xs \$3.4bn	Aon Benfield	Asia-Pac	Consolidated some layers; \$1.3bn second retention
2	Suncorp	\$5.2bn	\$5.2bn xs \$250mn	Aon Benfield	Asia-Pac	Dropped A\$500mn from top of programme
3	IAG	\$4.2bn	\$4.2bn xs \$250mn	Guy Carpenter	Asia-Pac	
4	Allstate	\$3.4bn	\$3.7bn xs \$500mn	Aon Benfield	US/Canada	Added \$475mn layer; not all layers 100% placed
5	CEA	\$2.9bn	\$2.9bn xs \$3.3bn	Aon Benfield, Guy Carpenter, Willis Re	US/Canada	
6	EQC	\$2.8bn	\$2.8bn xs \$1.2bn	Aon Benfield	Asia-Pac	Added NZ\$1bn
7	Intact	c.\$2.5bn	\$2.8bn xs \$50mn	Aon Benfield	US/Canada	New programme post buying Axa Canada; not fully placed
8	Allianz	\$2.5bn	\$2.5bn xs \$750mn	Guy Carpenter, Willis Re	Europe	
9	Chartis	\$2.5bn	\$2.5bn xs \$2bn	Guy Carpenter	US/Canada	Dropped \$2bn of traditional limit
10	Turkish Cat Pool	\$1.9bn	\$1.9bn xs \$220mn	Willis Re	Middle East	Increased retention
11	Generali	\$1.8bn	\$1.75bn xs \$250mn	Aon Benfield, Guy Carpenter, Willis Re	Europe	Consolidated reinsurance buying
12	Saikyosairen	\$1.7bn	\$1.7bn xs \$480mn	Aon Benfield, Willis Re	Asia-Pac	
13	Aviva	\$1.6bn	\$1.6bn xs \$500mn	Willis Re	UK	
14	Zurich	\$1.5bn	\$1.5bn xs \$300mn	Aon Benfield	Europe	
15	Axa	\$1.5bn	\$1.5bn xs \$375mn	Guy Carpenter, Willis Re	Europe	
16	RBSI	\$1.4bn	\$1.4bn xs \$195mn	Aon Benfield	UK	Modest retention increase
17	QBE	\$1.3bn	\$1.3bn xs \$200mn	Aon Benfield	Global	
18	Liberty	\$1.3bn	\$1.3bn xs \$1.3bn	Aon Benfield, Guy Carpenter, Tiger Risk, Willis Re	US/Canada	Dropped about \$400mn of limit
19	Chubb	\$1.2bn	\$1.15bn xs \$500mn	Guy Carpenter, Willis Re	US/Canada	
20	The Hartford	\$1.2bn	\$1.2bn xs \$350mn	Guy Carpenter	US/Canada	

* First event, main cat programme; exchange rates into US\$ - 4 July
The Insurance Insider sources and estimates

The Great California Disconnect



**2/3 of U.S.
earthquake risk**

The Great California Disconnect



**99.7% chance of a
6.7 magnitude or
greater in next 30 years**

The Great California Disconnect



**More than 90% of
California homes have
no earthquake insurance**

What the CEA has done

- Diversify – Given that we are a mono state, mono line catastrophe writer it is difficult to diversify in the traditional sense
- Reinsurance is one way to diversify
- The capital markets are another, currently \$600 million of our claims paying capacity comes from that.

Role of science in setting rates as mandated by Calif. Insurance Code

10089.40. (a) ...Rates shall be established based on the best available scientific information for assessing the risk of earthquake frequency, severity, and loss...

(b) (1) If scientific information from geologists, seismologists, or similar experts that assesses the frequency or severity of risk of earthquake is considered in setting rates or in arriving at the modeling assumptions upon which those rates are based, the information may be used to establish differentials among risks only if the information, assumptions, and methodology used are consistent with the available geophysical data and the state of the art of scientific knowledge within the scientific community.

(2) Scientific information from geologists, seismologists, or similar experts shall not be conclusive to support the establishment of different rates between the most populous rating territories in the northern and southern regions of the state unless that information, as analyzed by experts such as the United States Geological Survey, the California Division of Mines and Geology, and experts in the scientific or academic community, clearly shows a higher risk of earthquake frequency, severity, or loss between those most populous rating territories to support those differences.

CEA Funded Research

- \$2M for UCERF3 (Uniform Calif. EQ Rupture Forecast, ver. 3), \$1.75M for UCERF2 (see later slides)
- \$1.554M for NGA West2 -This project was designed to update ground motion prediction equations (GMPEs) that are one of the key components in a commercial loss model.
- CUREE Guidelines for Earthquake Damage Assessment and Repair

Research Partners



PEER



ATC

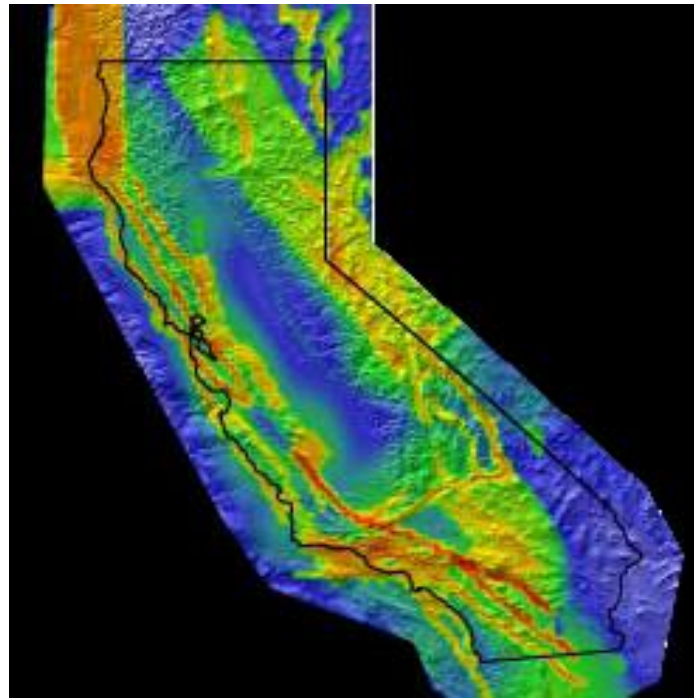
Applied Technology Council



FEMA



UCERF2 used a uniform time dependent methodology for the whole state



UCERF3 updated UCERF2

Designed to address assumptions in the UCERF2 methodology that subsequent earthquakes showed were incorrect. UCERF3 also incorporated additional scientific measurements that were not included in UCERF2.

For example:

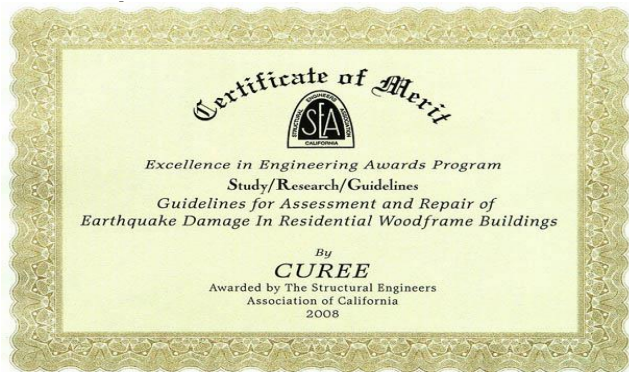
UCERF2 assumed that all earthquakes occurred within certain segments of a fault and with certain limited exceptions (e.g., the 1906 S.F. earthquake) it excluded multi-segment ruptures.

UCERF3 expressly provides for multi-segment ruptures throughout California.

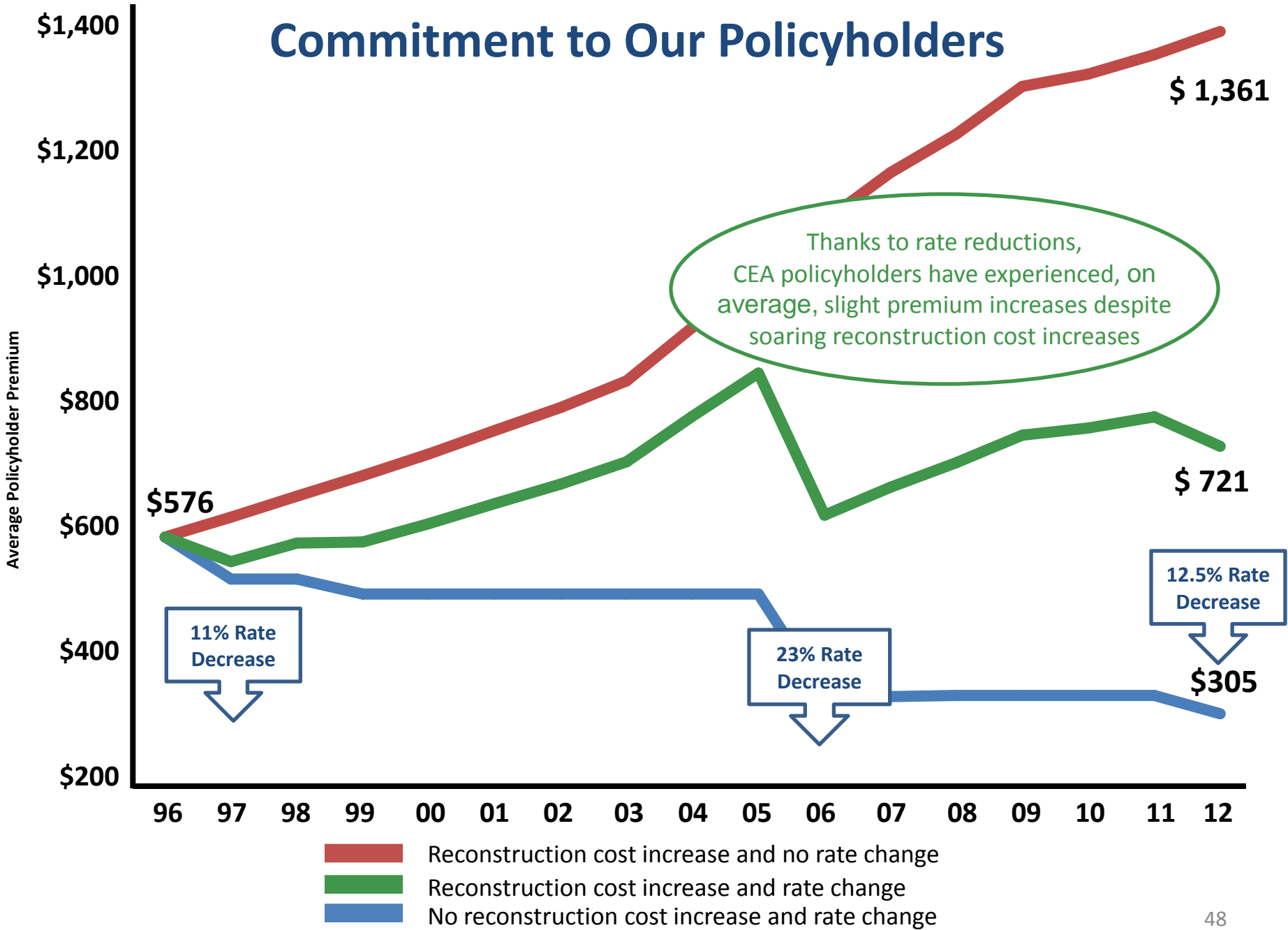
For the first time UCERF3 explicitly included geodetic data (e.g. GPS records of accumulating strain in California) to calculate earthquake rupture probabilities.

CUREE Guidelines for Earthquake Damage Assessment and Repair

The goal of this publication was to develop guidelines that provide a sound technical basis for use by engineers, contractors, owners, the insurance industry, building officials and others to facilitate improved consistency in the evaluation of building damage and the need for



Commitment to Our Policyholders



Insure

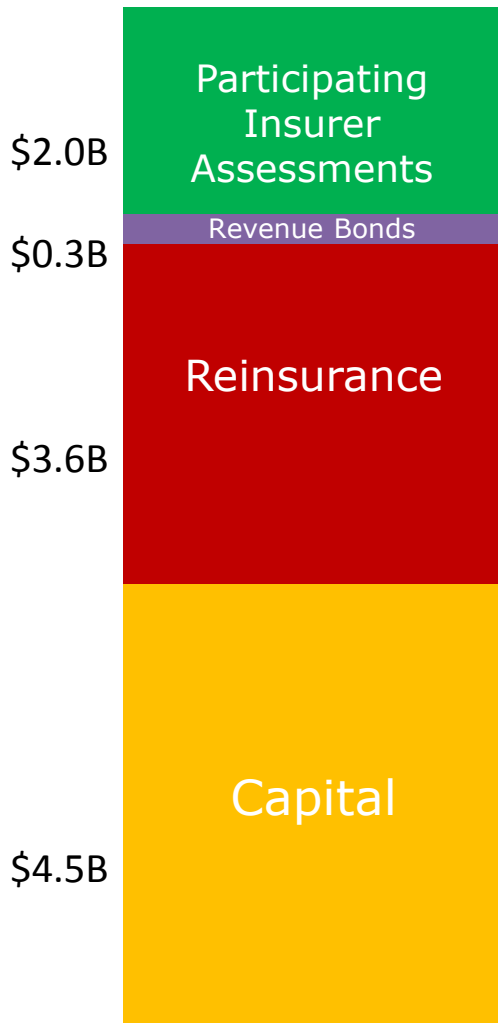
The Earthquake Insurance Affordability Act: S.1813



More affordable, valuable insurance
More money for education and mitigation

EIAA: Post event bonding potential will lower costs and increase financial strength.

Projected
2014 CEA Financial Structure



[Illustration only]
One potential structure with diversified risk transfer



- The potential for a limited amount of post-event borrowing will reduce exclusive reliance on pre-funded risk-transfer program.
- Probability of borrowing will be less than 2%.
- More flexible capital-management strategies will enable more affordable coverage and strengthen CEA's ability to prepare for subsequent events.

As of 4/1/14

Insure

Reform Mandatory Offer Law

Current notice is hard to read, inaccurate, boring... and 30 years old

Change how Californians learn about – and buy – earthquake insurance.

CALIFORNIA LAW REQUIRES THAT EARTHQUAKE COVERAGE BE OFFERED AS AN OPTION.

WARNING: THESE COVERAGES MAY DIFFER SUBSTANTIALLY FROM THE PROTECTION THAN THE COVERAGE PROVIDED BY YOUR CURRENT POLICY. THERE ARE EXCLUSIONS AND LIMITATIONS SUCH AS MASONRY FENCES, AND MASONRY CHIMNEYS. THIS IS A GENERAL DESCRIPTION OF COVERAGES AND IS NOT A DETAILED POLICY. ONLY THE SPECIFIC PROVISIONS OF YOUR POLICY PARTICULAR LOSS IS COVERED AND, IF SO, THE AMOUNT OF COVERAGE.

Dear Policyholder:

Did you know that your homeowners policy does not cover earthquake damage to your home or its contents?

For earthquake coverage, you need a separate earthquake insurance policy from the California Earthquake Authority (CEA).

[Company] has teamed up with the CEA to get you covered – so you can get your life back to normal after the next damaging earthquake. A CEA policy sold by [Company] combines the customer service we're proud of with the financial strength you can count on.



Protect yourself and your family for when an earthquake strikes. Call for your quote today!

Reform Mandatory Offer Law

- Replaces the existing, legalistic mandatory offer with a conversational, plain-English approach.
- Removes confusing language so policyholders know that CEA insurance is always available for purchase.
- Establishes more frequent communication with policyholders who don't have earthquake insurance.
- Raises the 17-year old cap on CEA's core admin expenses from 3% to 5% of premium income.

And just in case you were curious about our rating classifications

Classification

- Location – 19 groups
- Construction type – Frame, Masonry, Mobile Home
- Age – 5 groups (applicable to HO Dwelling)
- Number of Stories – 2 groups (applicable to HO Dwelling)
- Foundation – 3 groups (applicable to HO Dwelling)
- Hazard Discount
 - 5% maximum for HO Dwelling
 - 65% maximum for mobile homes with ERBS

What does the future hold?



**DID SOMEONE FORGET TO PAY THE
EARTHQUAKE BILL?**

**JACKSON, D. D., UCLA, Los Angeles, CA, USA,
david.d.jackson@ucla.edu**

Paleo-seismic data for California imply a long term rate corresponding to a recurrence interval of decades, yet the rate during the instrumental seismic measurement era is considerably less.

When the next EQ happens what will it cost?



- RMS models a \$260B loss for a repeat of the 1906 EQ
- AIR, EQE and RMS model a \$80-140B loss for a repeat of the Northridge EQ
- AIR model a \$295B loss for a repeat of the 7.8 Southern San Andreas Shakeout scenario

Who pays?

- EQE projects a 90B Northridge loss, only \$15B of it covered by insurance and most of that is in the commercial sector
- In the Northridge EQ 50% of residential losses were covered by insurance, in the next Northridge it will be less than 25%
- In Northridge the Federal gov't paid approx. \$9B, less than insurers, next time?

For all the big brains out there

- Questions?
- But more importantly, any suggestions?



Bruce Patton, Director of Policy, Research &
Special Projects at the CEA
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