Organizations Harnessing Open Source Simulations to Address Climate Change

Addressing climate change will require,

amongst most everyone from business and government leaders to global citizens,

exponential, cross-cultural diffusion of two ideas:

1. We need to reduce CO_2 emissions significantly

2. How to do it while supporting our economy

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CLIMATE INTERACTIVE

A Group of Leaders was Assembled in 2006 by MIT Faculty at Citigroup in NYC to Found a New Effort

Andrew Jones, Sustainability Institute, Program Director
10 years experience in system dynamics

Dr. John Sterman, MIT Sloan School of Management
Director, System Dynamics Group
Author, *Business Dynamics: Systems Thinking and Modeling for a Complex World*

Dr. Peter Senge, MIT,
Senior Lecturer, Sloan School of Management,
Founding Chairman, Society for Organizational Learning
Author, *The Fifth Discipline*

Marv Adams, Fidelity Investments, President, Shared Services
Former CIO, Citigroup
Former SVP of Corporate Strategy and CIO, Ford Motor Co.

Dr. Michelle Erickson, Citigroup
Director, Sustainability Initiative for Global IT

Michael Richards, Visioneering Partners, President
Former VP of IT, Monsanto
Former CIO, Ford Motor Co.

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In 2006, this small group of leaders hypothesized it would take:

accessible, interactive simulations

shared open source

spreading virally around the world

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Innovative Organizations have Joined and Grown the Effort

Sustainability Institute Boosted its Climate Interactive Team

Dr. Elizabeth Sawin - Co-Director of Climate Program, climate science, writing, analysis, presentations

Dr. Phil Rice – Climate science, interface creation, learning design and documentation

Stephanie McCauley - Web development, interface creation, user community management

Dr. Lori Siegel – Simulation research, creation, and testing; climate and energy science

With Partners We Developed C-ROADS the Policy-Maker Oriented Climate Simulation

- Uses MIT-based technology
- Designed for decision makers, not just scientists
  - Runs in less than 0.1 seconds
- Scientifically Reviewed
  - Committee chaired by Dr. Bob Watson, former head of the IPCC

"C-ROADS reproduces the response properties of state-of-the-art three dimensional climate models very well"

  - Committee members included Klaus Hasselmann and Stephen Schneider
- Flexible and adaptable to the week's burning policy questions
- All equations shared and open to scrutiny

MITSloan

VENTANA systems, inc.

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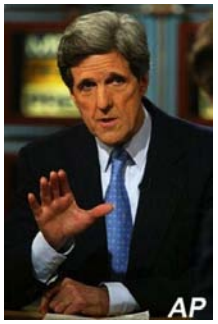
With Partners in the Climate Action Initiative, C-ROADS Has Already Impacted Global Decisions

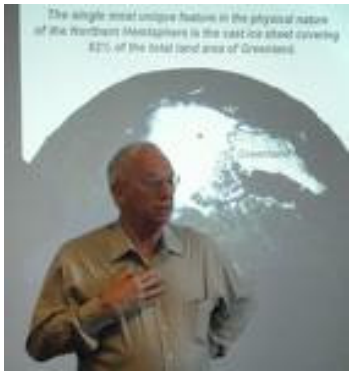
- US State Department Deputy Special Envoy for Climate Change Jonathan Pershing presented C-ROADS slides in plenary to the UNFCCC in Bonn
  April 2009

- Senator John Kerry quoted C-ROADS results and showed graphs in Congress –
  January 2009



- European Environment Agency head, Jacqueline McGlade, quoted C-ROADS in European talks

- Bob Corell quoted C-ROADS in interview on NPR
  February 2009



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CI has already Engaged Key Industry, Government, and Institutional Clients …

Center for a New American Security

Used sims to support a July 2008 "War Game" chaired by John Podesta and covered by ABC News

ERICSSON
TAKING YOU FORWARD

Created a sim used by Ericsson for climate strategy from shop floor to CEO

WMO INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE UNEP

Created sim-based slide deck for Dr. Bill Moomaw to present to IPCC committees

Morgan Stanley

Embedded a sim in a video used in sustainability education across the firm

nyssa
New York Society of Security Analysts

Ran a sim-based workshop in NYC for capital markets analysts on electric generation and climate

Schlumberger

Co-created a sim used around the world in seven languages

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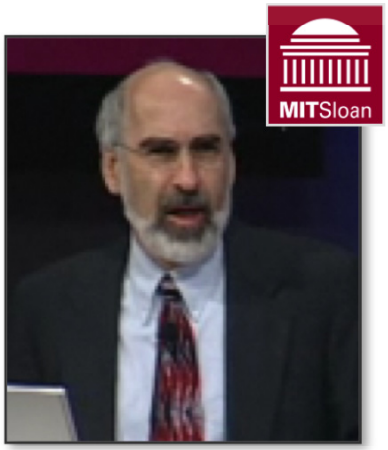
With MIT, We Developed Interactive Policy Exercises Engaging Diverse Leaders



Oil Executives at MIT

European Business Leaders in Greenland

European Environmental Officials, Copenhagen

Corporate Executives with The Climate Group

Duke MBA Students

CAI Climate Action Initiative

Plus:

- Citizen leaders in NH
- Civic leaders in Atlanta
- Society for Organizational Learning (SoL) leaders

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Now Technologists and Software Developers Are Asking for Access to the Sims

- **Chinese NGO Civic Exchange (Hong Kong)**
  Could we translate the sims into Chinese?

- **Gore's "The Climate Project"**
  Could we use the sim to empower citizen leaders?

- **New England Science Museums**
  Could we embed the sim in an interactive "touch screen" exhibit?

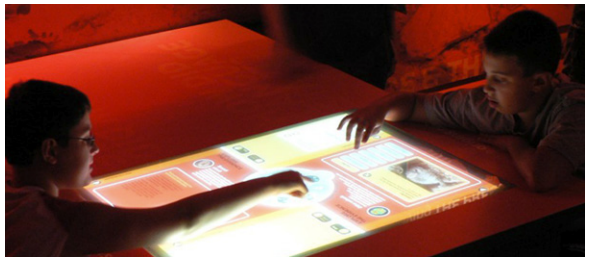
- **Carbon Quilt**
  Could the sim drive the visualization of carbon footprint data?

- **Terrestrial Carbon Project**
  Could we enhance the sim's forests sector?

- **MIT's Center for Collective Intelligence**
  Could we develop "argumentation and deliberation" space?

思匯 CIVIC EXCHANGE

THE CLIMATE PROJECT. ORG



MIT CENTER FOR COLLECTIVE INTELLIGENCE

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Climate Leaders Around the World Are Also Asking Us to Share Simulation Graphs and Results

- **Todd Stern, Special Envoy on Climate Change, US State Department, via Bob Corell**
  Could you run more scenarios?

- **Government of Mexico**
  Could we run an online webinar on UN Strategy?

- **Government of Sweden**
  Could we give a plenary talk at Sweden's "Political Week" as they take on EU Presidency?

- **The World Bank Foundation**
  Could we use it to train developing country climate leaders?

- **Project Catalyst of ClimateWorks**
  Could you analyze proposals to COP-15?

- **Peter Senge and BP**
  Could we use it to support youth leaders?

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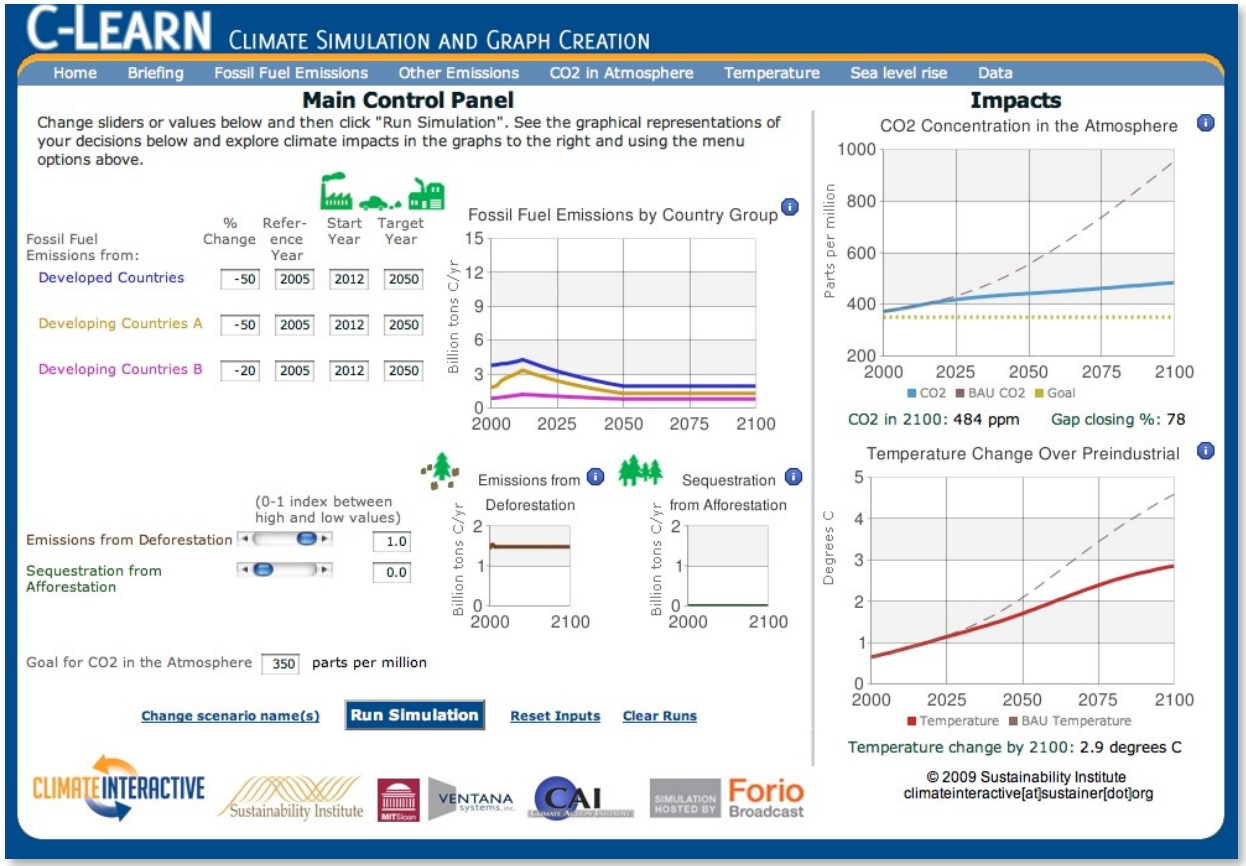
To Meet the Overwhelming Demand, We Created C-Learn as Globally-Accessible Online Freeware



Launched May 2009
Available at: www.climateinteractive.org

We will share:

1. All equations
2. Simulation in Vensim software (with a GPL license)
3. Code to the xhtml interface (with a GPL license)
4. Graph sets with data behind them

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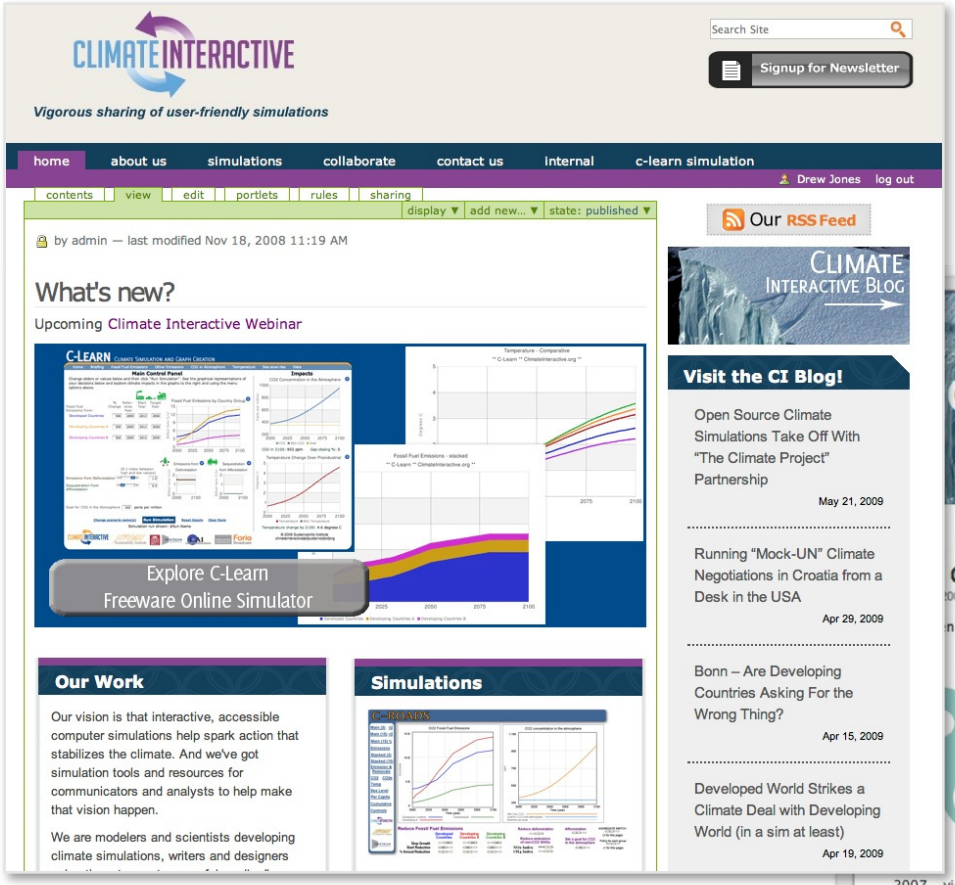
We Created a Website and Blog to Share the Sims



www.climateinteractive.org

climateinteractive.wordpress.com

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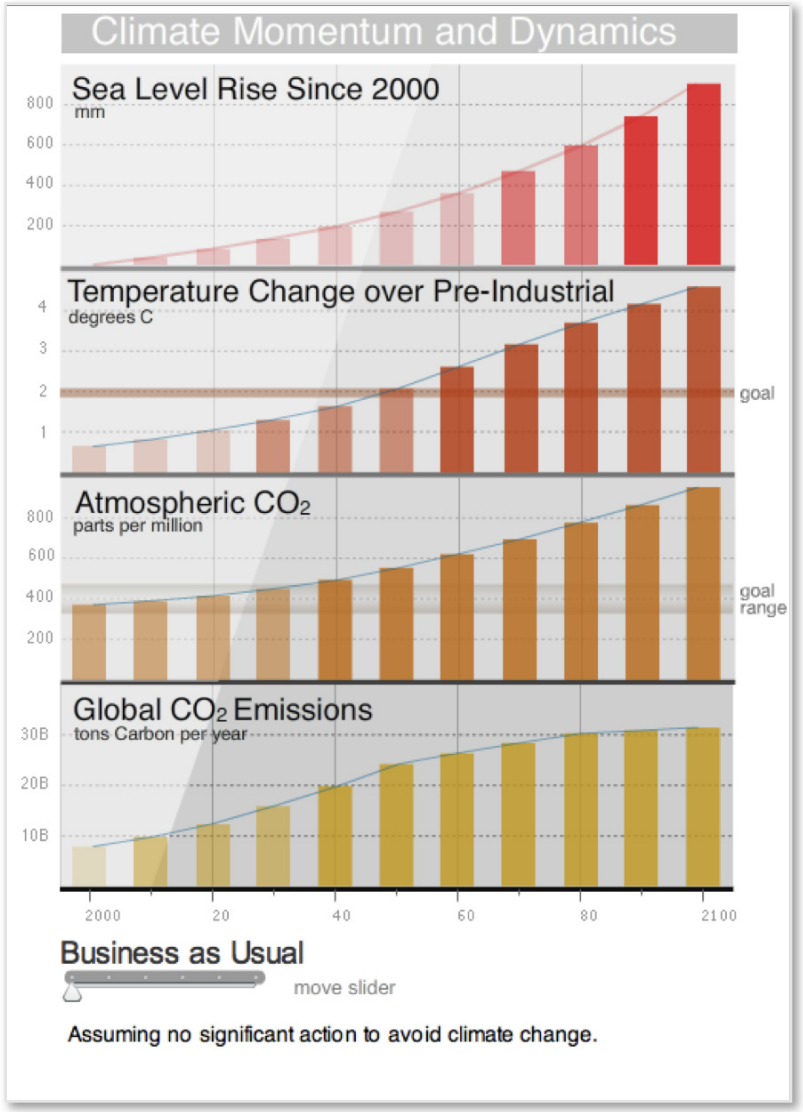
We Created a Prototype "Flash" Animation that Could Spread Virally

- Built using Edward Tufte's information design approach
- Modeled after the NY Times' online graphics



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Think Bigger. What If…?

(All technically possible but not happening yet…)

- Millions of people play a free C-ROADS game on their iPhone
- Every two weeks an analyst working for AOSIS, the island nation's advocacy group, has access to a set of graphs that shows the "state of the global deal" in Temperature and Sea Level rise terms.
- A climate advocate in China can ask "what if" questions of a free, online, international simulation tool. In Chinese.
- Google Earth includes a new feature where users can change global CO2 emissions and, via C-ROADS, see detailed maps of sea level rise and displaced populations under the scenario they created.
- Youth leaders in 132 countries run thousands of "Mock UN" summits using a free online sim, guided by a free online facilitator's guide, engaging hundreds of thousands of young leaders.
- An international network of analysts use a stable, attractive version of C-ROADS to determine paths to climate stabilization and to assess proposals, no modeler needed. C-ROADS becomes a standard and accepted tool of analysis.
- By January 2010, a similar suite of engaging tools and approaches enters the world addressing a new question: HOW to build a new economy with low-carbon transportation, electrical generation, buildings, lifestyles, and policies?

And what if a modest investment could empower OTHERS to make all this happen?

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CI's Approach is to Share, Enable and Support

(Not Try to Do it All Ourselves)

Our **goal** is to do for the world of **climate sims** what

YouTube did for **amateur video**

and what

Wikipedia did for **encyclopedias**.

We will ensure top scientific standards.

All models will be externally reviewed.

We are catalysts—here to empower creative people to translate, extend, and improve this excellent work.

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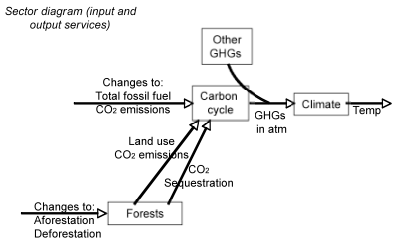
CI's Approach Enables Sharing Simulations and Media on Multiple Levels

Models

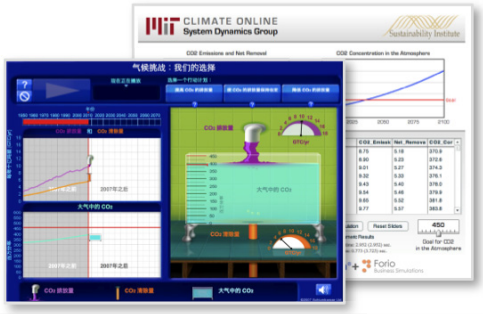
Mathematical equations



1. **Share Equations**
   - **Create world class models**
2. **Share Model Output on Web**
   - **Expand model usage within model developers**
     - Enable repurposing of model output in any program (e.g., mash-up with Google Earth)

Interfaces

Programs that allow users to visualize and study models (e.g. Flash, video games, Forio Broadcast)



3. **Share SI Code**
   - **Augment model usage**
     - By creating new interfaces and languages
4. **Promote Simulator Use and Dialog**
   - Facilitate climate **decision making based on best information**

Media

Documents that explain simulations (e.g. YouTube videos, presentations, podcasts)

5. **Broaden Communication of Model Results**
   - Aggregate climate simulation materials to **become knowledge center**
   - **Communicate model results broadly** for layperson use

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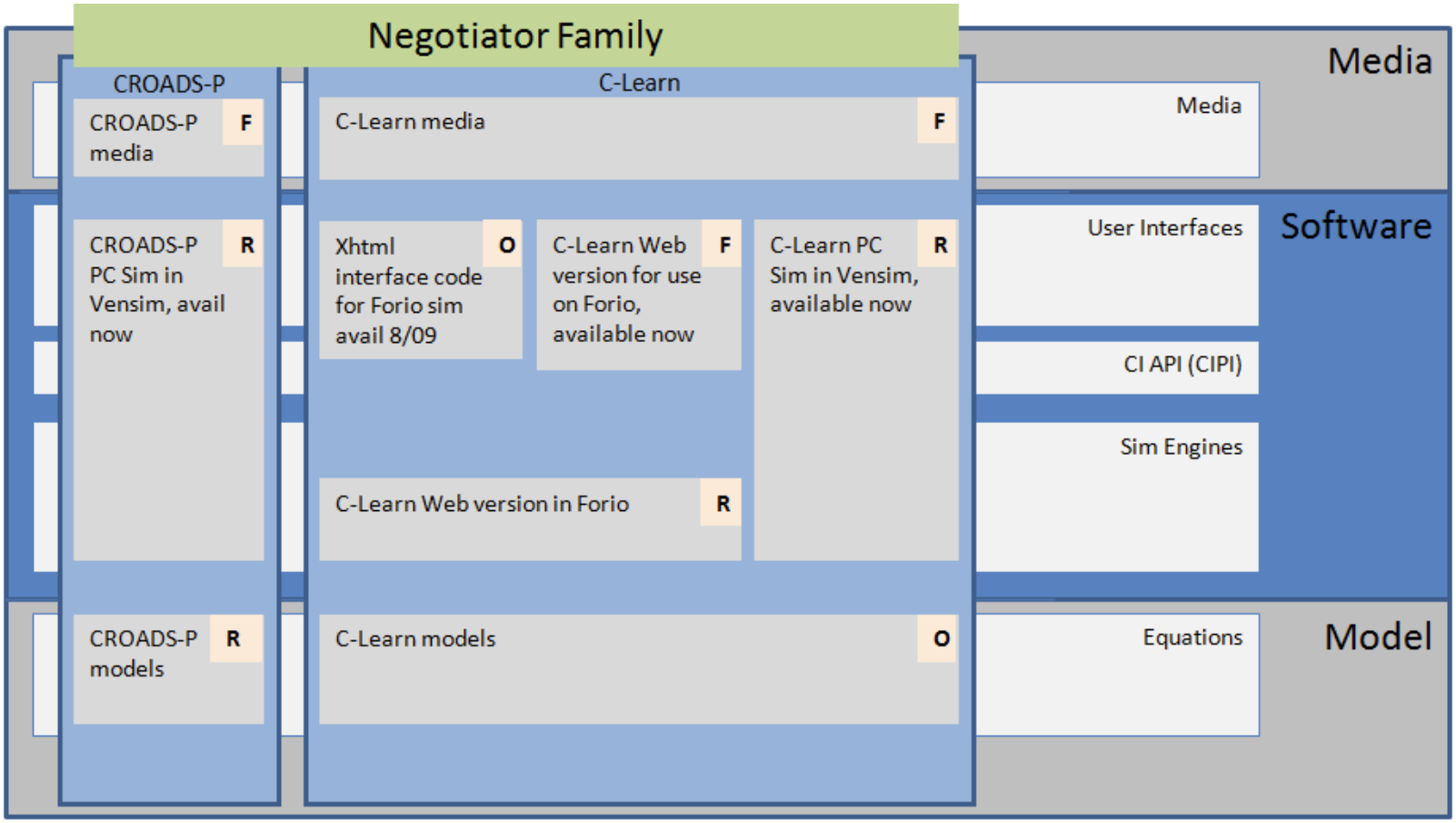
Our Technology Strategy Identifies Different Versions of the Sim with Different Levels of Access to Partners



Levels of Capability
- **-P** **Professional** version designed for sophisticated but common use
- **-L** **Lightweight** version suitable for learning and common use
- **-S** **Special** purpose, custom designed for specific audience

Key for Classes of use:
- **F**ree to download or use
- **O**SL (open source licensed)
- **R**estricted

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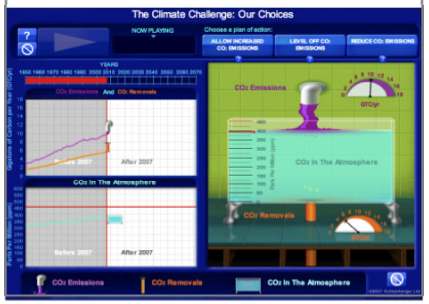
We are Aiming Beyond C-ROADS:
CI Currently has Four Broad Types of Climate Simulations …

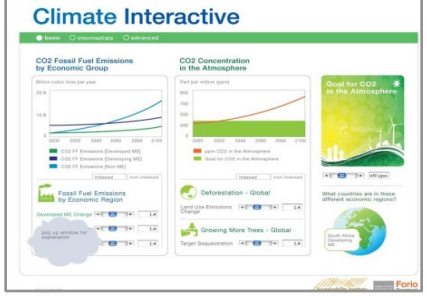
The Motivator

- Simple models that explain the unexpected consequences of climate impacts



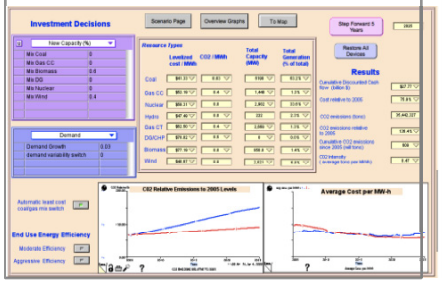
The Negotiator

- Models that help multiple parties play 'what if' games to understand their actions impacts



The Regulator

- Models that take into account government or other regulatory actions to assess best courses of action



The Investor

- Models that help make wise investment choices and reduce risks of non-optimal plans...or worse

Proposed Data Center Simulation

… that can be extended with new science, additional user interfaces, as well as added functionality unique to a particular domain

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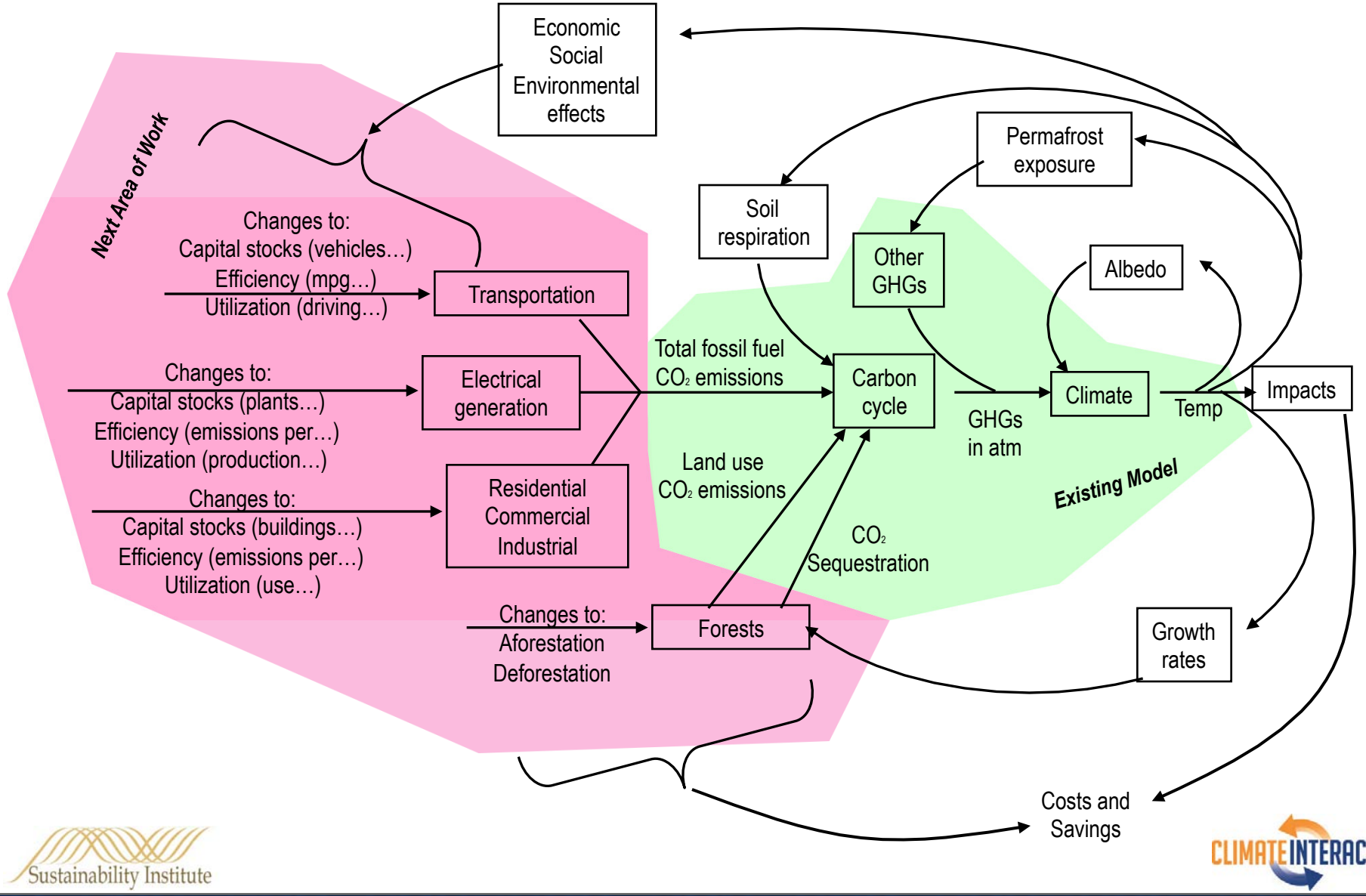
Next Simulation Underway:
How to Reduce Emissions and Improve the Economy?



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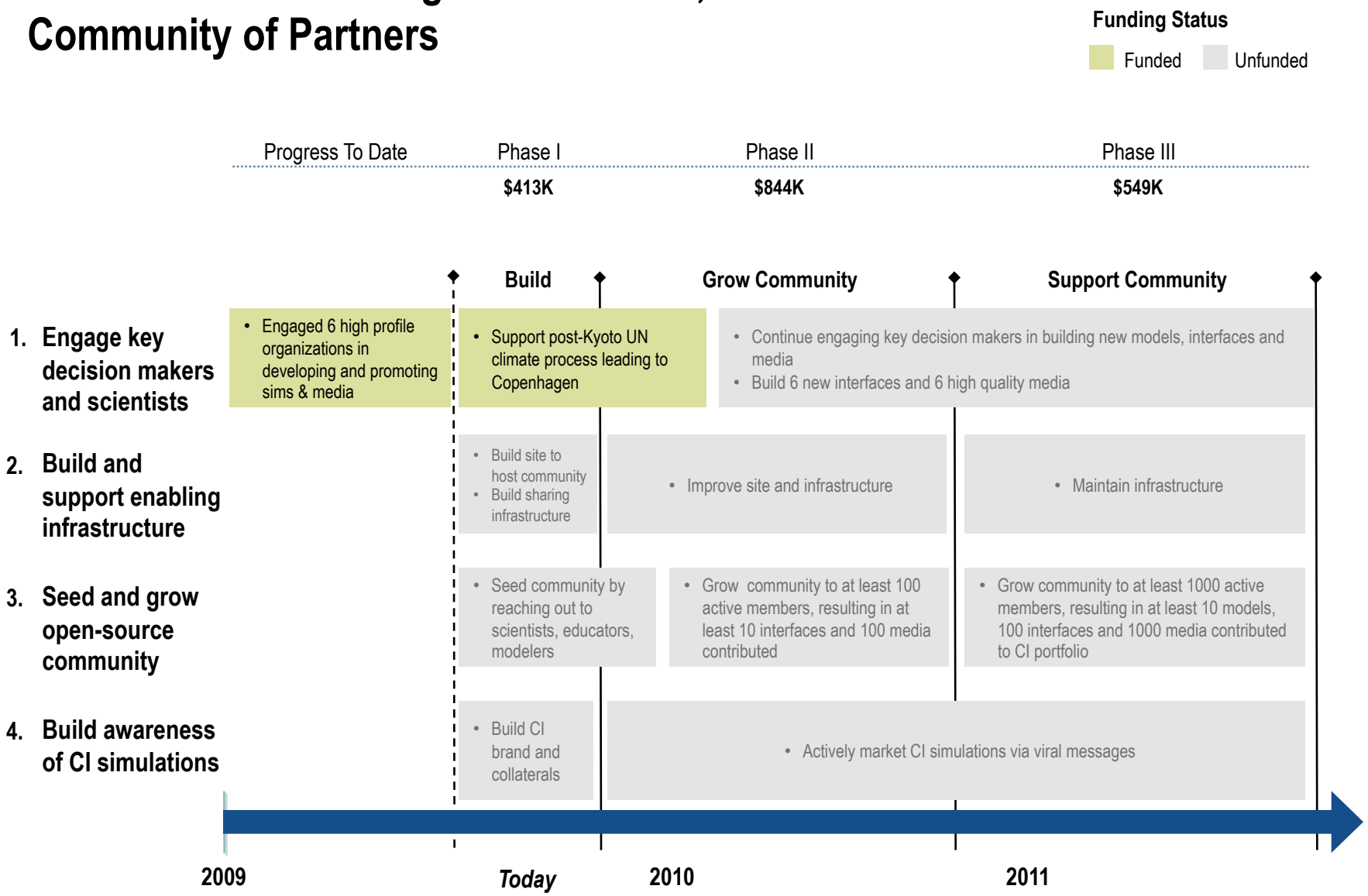
CI Plans to Further Augment its Tools, Science and Community of Partners



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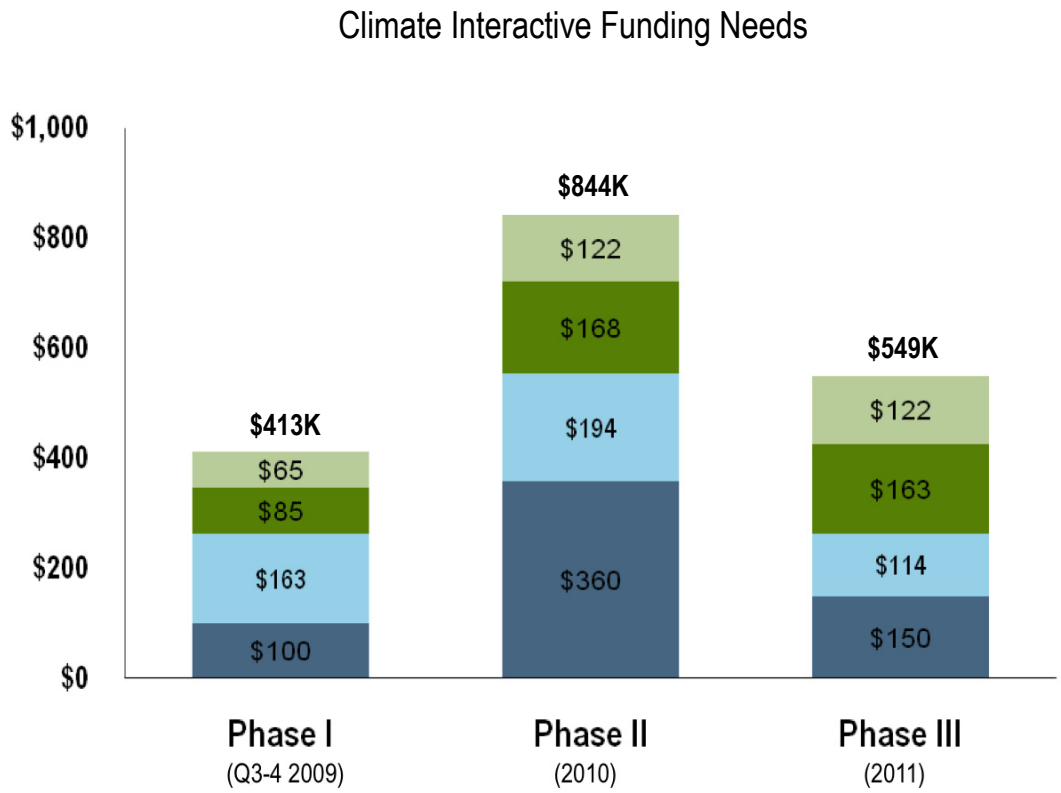
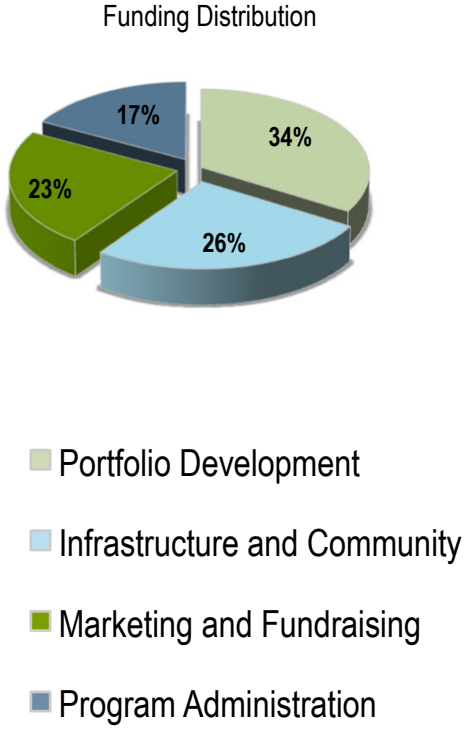
To Bring the Capability to Market, CI Seeks $1.8M in Funding Through 2011





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Key Areas of Budget over 2.5 years

- Create and support the "open architecture" infrastructure and community
  - ~$1.7 million (see breakdown on previous page)

- Core work on C-ROADS and the Next Emissions Reduction Simulator
  - Improve, update, and document the C-ROADS simulation
    - ~$500k
  - Engage global decision-makers with simulation-based strategy sessions and the policy exercise towards policy and behavior change (with the Climate Action Initiative)
    - ~$600k
  - Engage global civil society, media, and NGOs with online simulations and simulation results and analysis
    - ~$400k
  - Extend C-ROADS and develop new engagement approaches
    - ~$1 million

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There Are Also Specific Products We Hope to Create

- Develop online documentation, “presenter coaching” and curriculum development for C-ROADS simulation
    - ~$50k
- Support creation of the “Facilitator’s Guide” and facilitator trainings/webinars to the “Mock-UN” policy exercise, “The Copenhagen Climate Exercise.”
    - ~$30k
- Develop 4 flash animations of the key simulation results (similar to the Tufte-inspired “Climate Momentum and Dynamics”)
    - ~$120k

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We Have 5 Sponsorship Levels for Climate Interactive

Friend	up to $10k	Listing on website
Sponsor	$25k	Listing on website and in materials
Sustainer	$75k	Logo on presentations, materials and website
Benefactor	$200k	Plus offer of private webinar training/presentation session for unlimited participants
Endower	$500k +	Plus seat on “Board of Advisors” for Climate Interactive

We are a registered U.S. not-for-profit organization.

All contributions are tax-deductible as allowed by law.

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We are a Growing Coalition With a Shared Mission to Deliver Tools to Enable Climate Stabilization

Business Organizations

citi

Schlumberger

Fidelity INVESTMENTS

if PEOPLE

MISSION

To enable and support a community that creates, shares, and uses credible simulations and media to improve understanding of climate dynamics and accelerate action towards climate stabilization.

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society for SOL organizational learning

THE HEINZ CENTER

ACTIVE PHILANTHROPY

zennström PHILANTHROPIES

MORGAN FAMILY FOUNDATION

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Academic/Science Organizations

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www.climateinteractive.org

To receive background documents and
occasional updates,
send an email now to:

climateinteractive@sustainer.org

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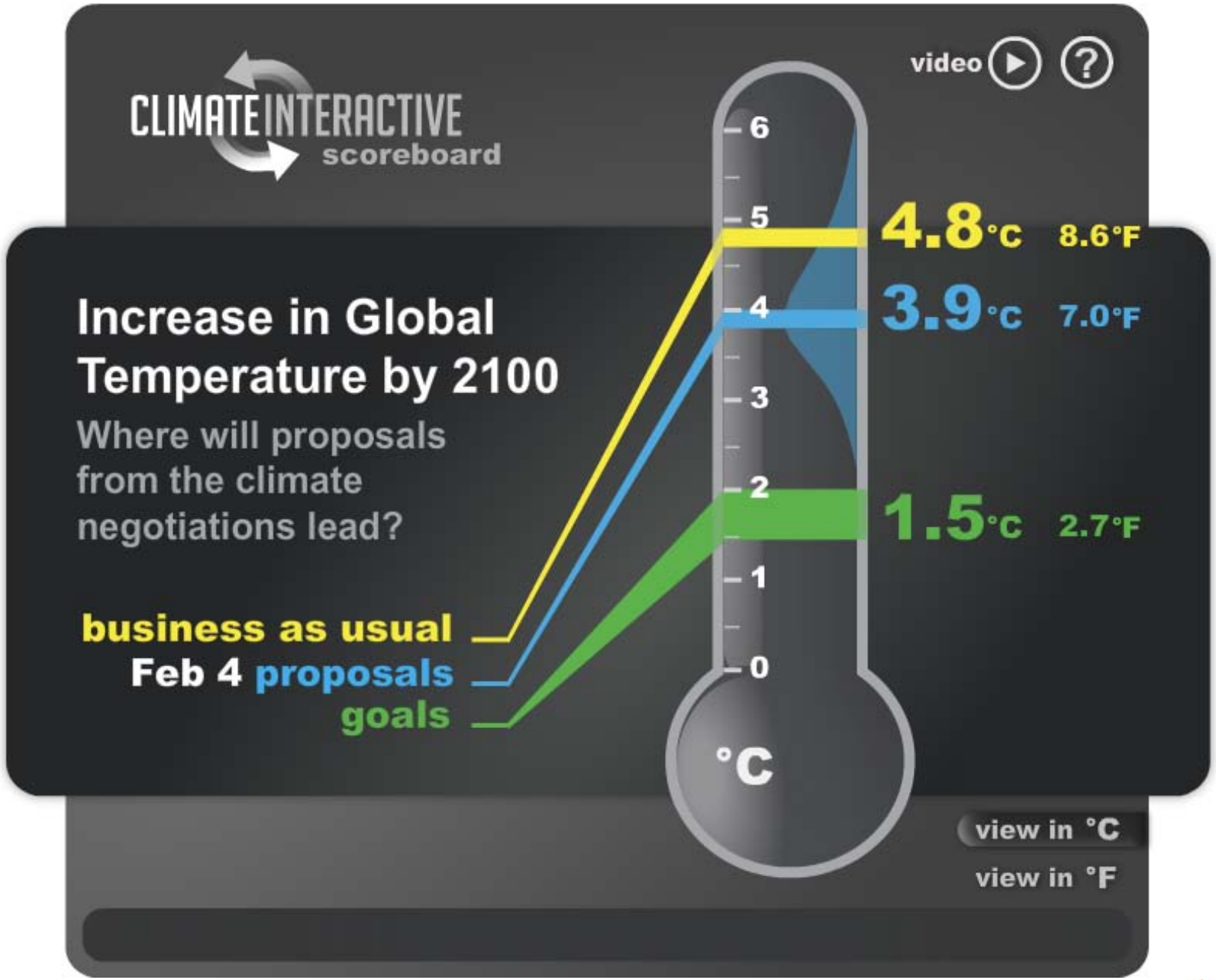

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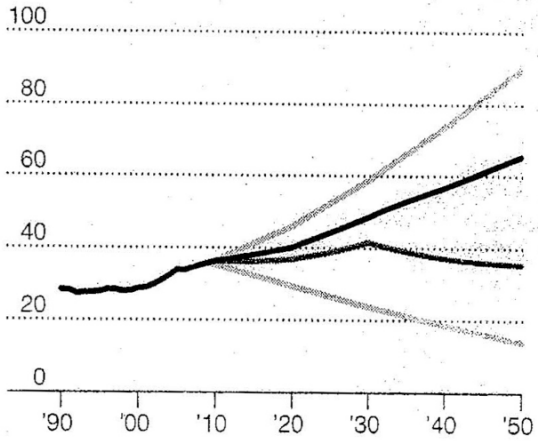
International Herald Tribune

SATURDAY-SUNDAY, DECEMBER 19-20, 2009 THE GLOBAL EDITION OF THE NEW YORK TIMES GLOBAL.NYTIMES.COM

Will it be enough?

The chart shows the estimated impact of proposals put on the table by major countries in Copenhagen. "Business as usual" is what the Intergovernmental Panel on Climate Change believes will happen if no effort is made to curb emissions. Confirmed proposals are official pledges, while potential proposals include reductions merely under consideration as well as those with conditions. The low-emissions path is roughly the amount of reductions scientists say are necessary to limit the rise in global temperatures to acceptable levels. A substantial gap remains between that level and what has been proposed so far.

Global emissions of CO_2
In billions of tons, annually



Source: Climate Interactive's Climate Scoreboard

	Atmospheric CO_2 in 2050 in parts per million		
	CO_2	CO_2 equivalent	Temperature increase*
"Business as usual"	**965**	1,410	**4.8° C** (2.9° - 7.7°)
Confirmed proposals	**755**	990	**3.8° C** (2.3° - 6.1°)
Potential proposals	**590**	725	**2.9° C** (1.8° - 4.7°)
Low-emissions path†	**450**	505	**1.9° C** (1.1° - 3.0°)

*Increase over preindustrial levels in 2100. †Meant to limit the rise in global temperatures to less than 2 degrees Celsius through a 50% reduction in and stabilizing of emissions by 2050.
Note: All proposals are as of Tuesday.

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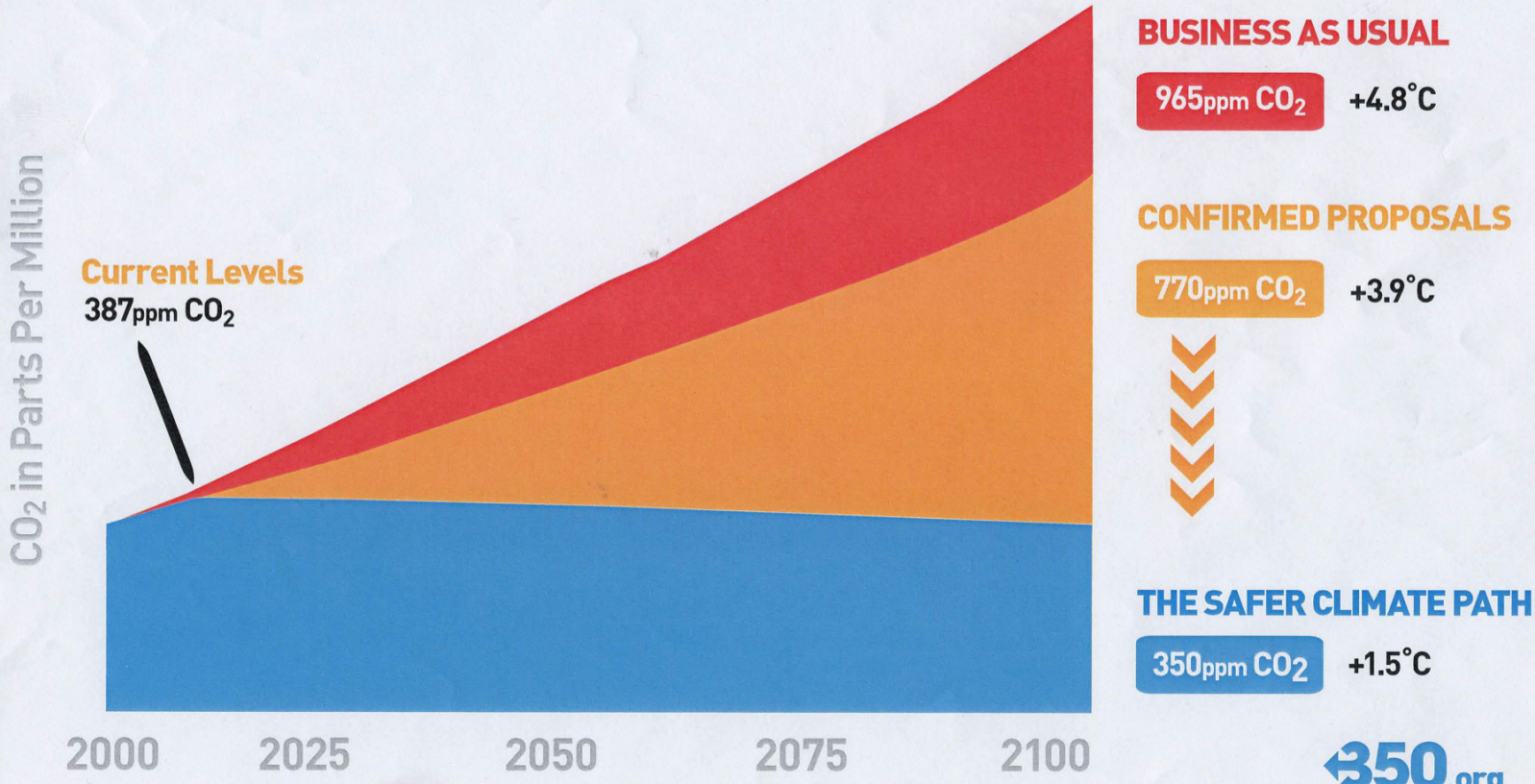
Where will current COP-15 climate proposals lead?

CO_2 concentrations by 2100. Graphics Based on Projections by Climate Interactive.
(www.ClimateScoreBoard.org)



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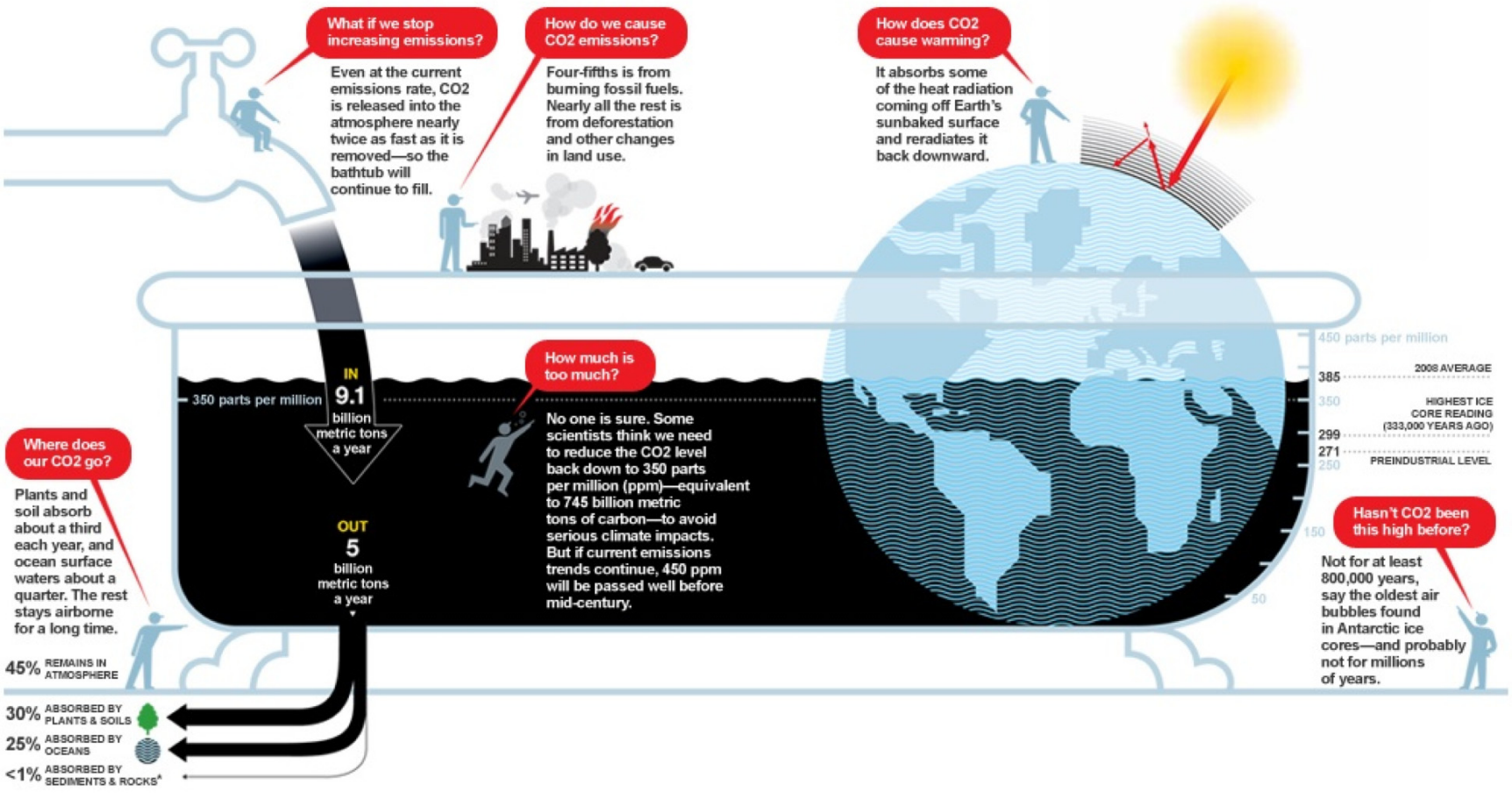
The Big Idea

December 2009



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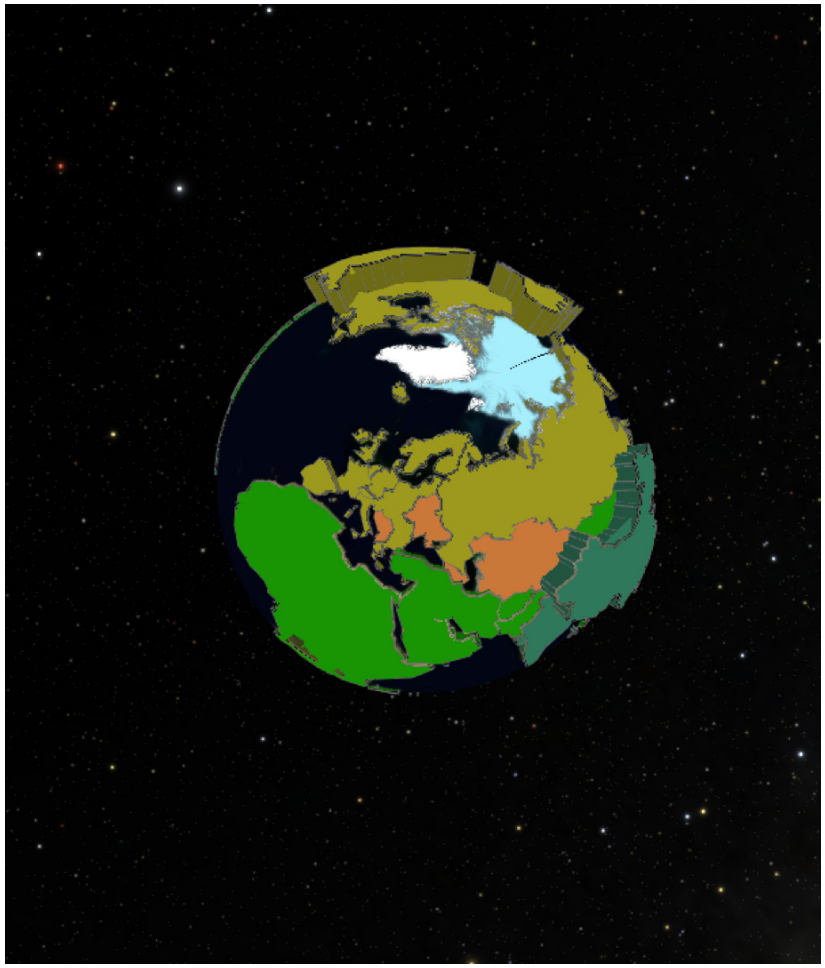
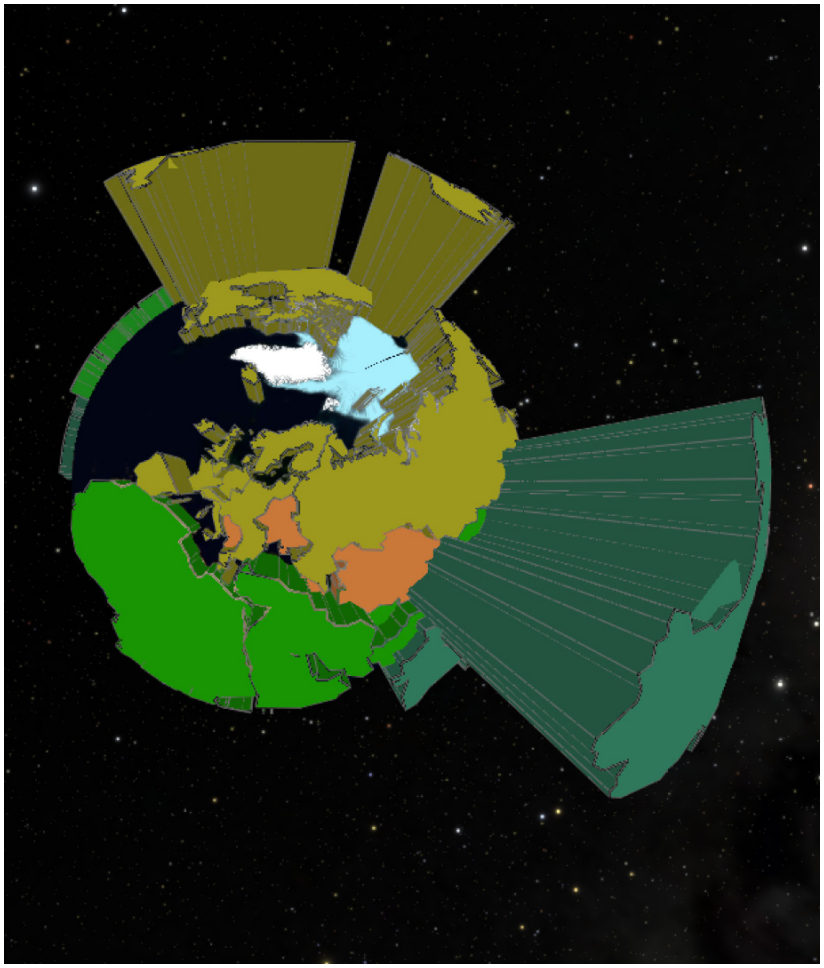


Two Degree Future
2050 Fossil Fuel Emissions



Business as Usual Future
2050 Fossil Fuel Emissions

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Sweden

Netherlands

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C-LEARN CLIMATE SIMULATION

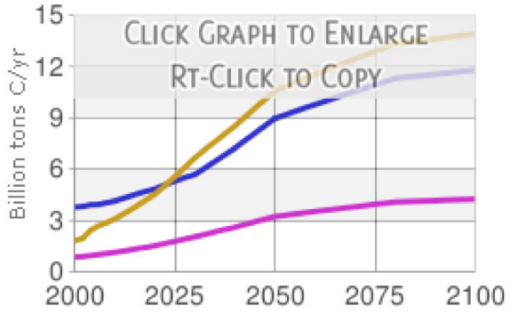
Home | Briefing | Fossil Fuel Emissions | Other Emissions | CO2 in Atmosphere | Temperature | Sea level rise | Data

Main Control Panel

Change sliders or values below and then click "Run Simulation". See the graphical representations of your decisions below and explore climate impacts in the graphs to the right and using the menu options above.

Fossil Fuel Emissions from:	% Change	Reference Year	Start Year	Target Year
Developed Countries	500	2005	2012	2050
Developing Countries A	500	2005	2012	2050
Developing Countries B	500	2005	2012	2050

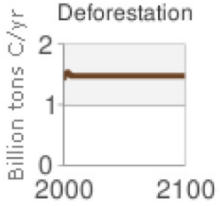
Fossil Fuel Emissions by Country Group



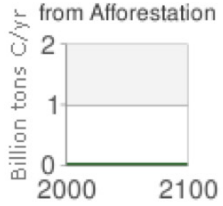
(0-1 index between high and low values)

Emissions from Deforestation	1.0
Sequestration from Afforestation	0.0

Emissions from Deforestation



Sequestration from Afforestation

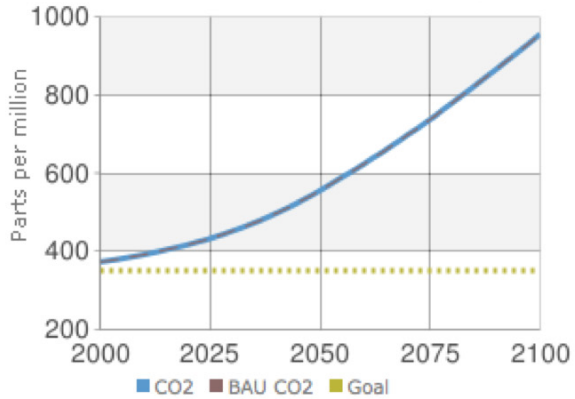


Goal for CO2 in the Atmosphere 350 parts per million

Change scenario name(s) | **Run Simulation** | Reset Inputs | Clear Runs

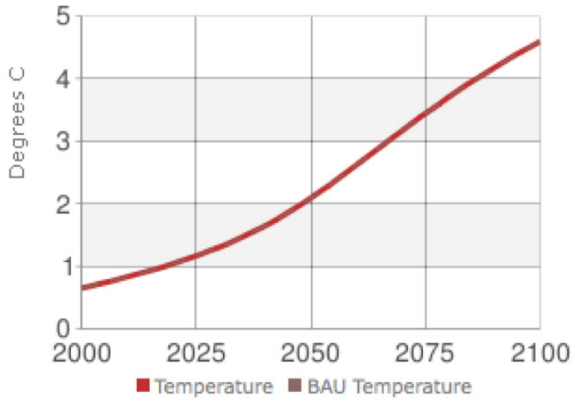
Impacts

CO2 Concentration in the Atmosphere



CO2 in 2100: 955 ppm Gap closing %: 0

Temperature Change Over Preindustrial



Temperature change by 2100: 4.6 degrees C

Comments/Suggestions?

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News

- Debate barn-raising launched: Is the earth's climate changing because of human activity? (more)
- "Copenhagen Challenge" final round winners announced (more)
- Climate Collaboratorium launches new site (more)
- Collaboratorium announces "Copenhagen Challenge" (more)

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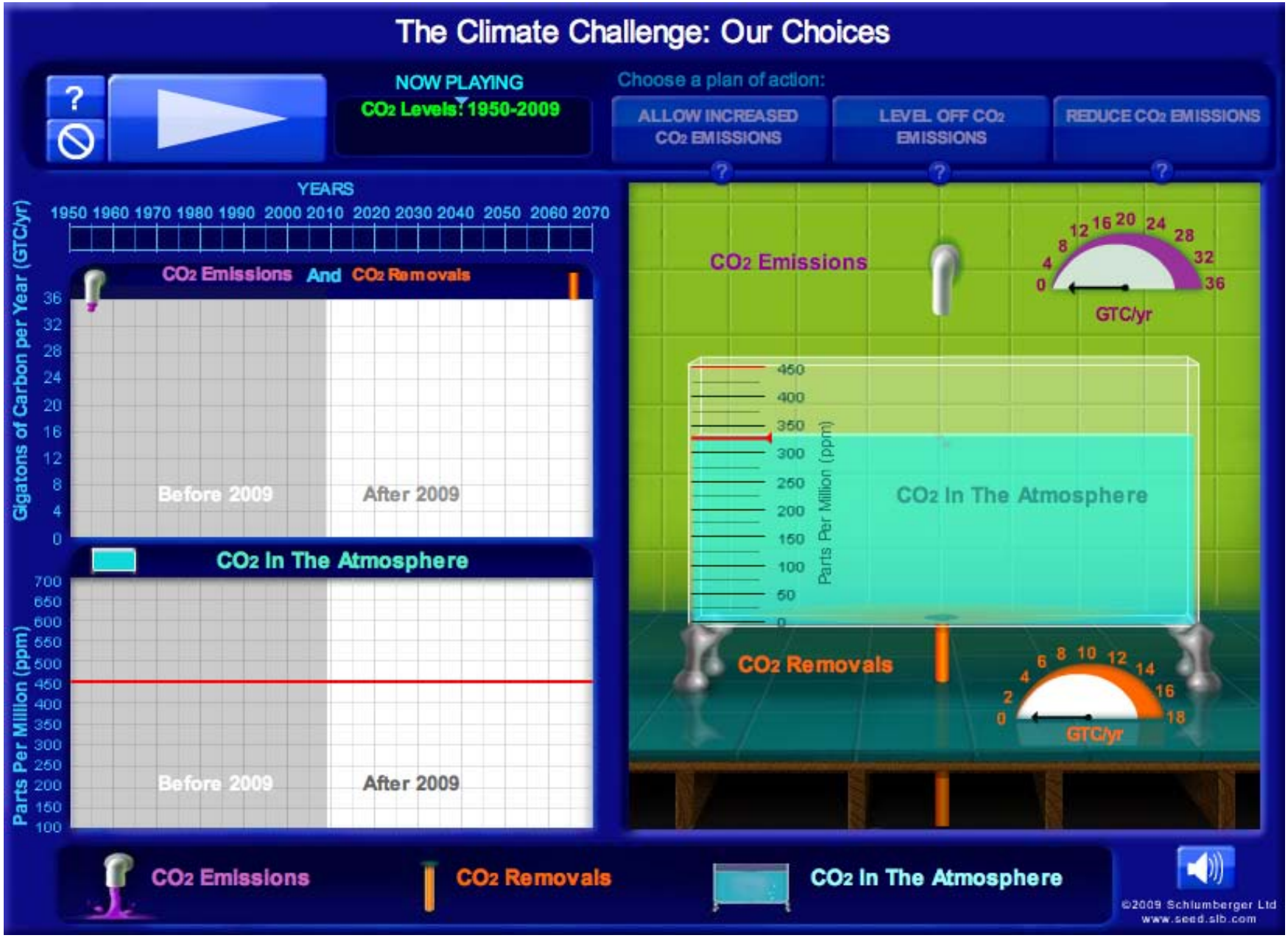

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