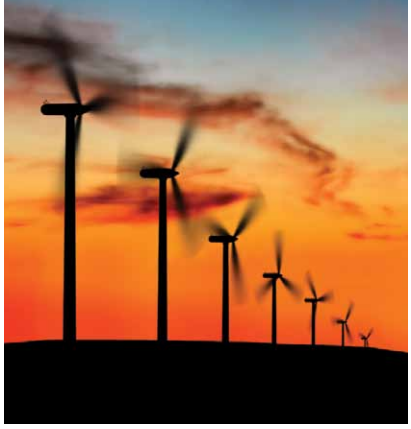
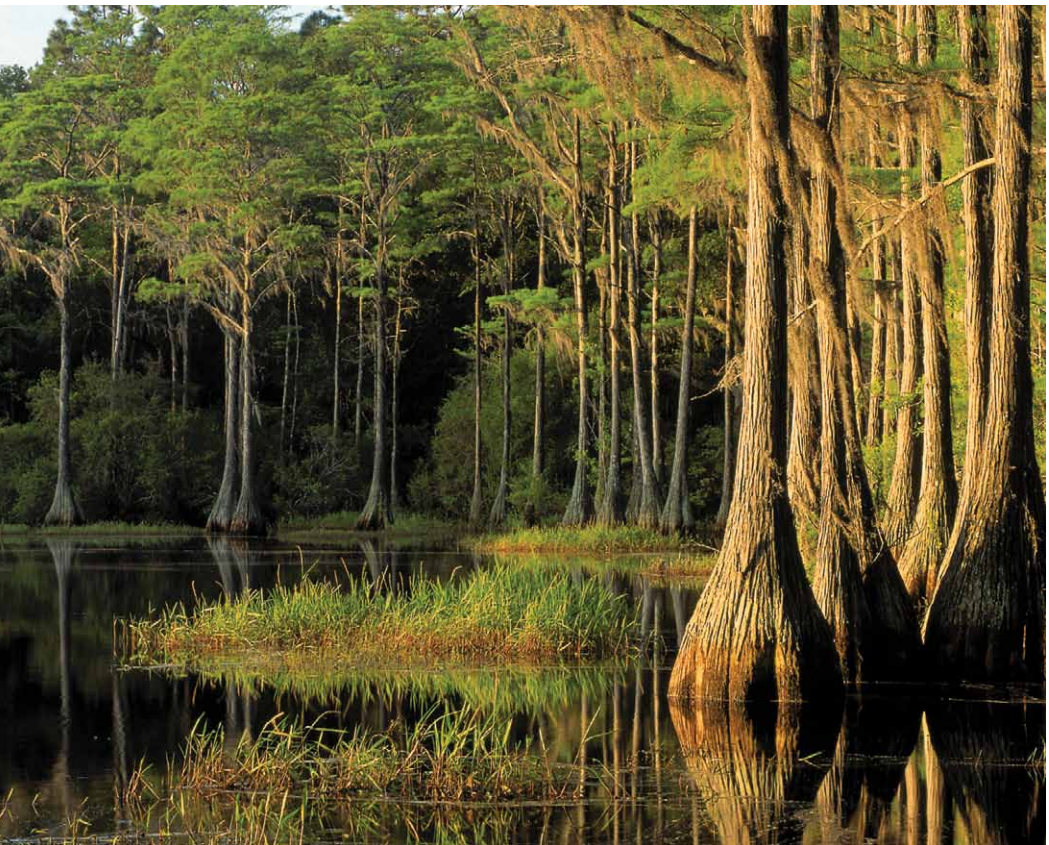




POWERING A BRIGHT FUTURE

"It takes as much energy

to wish as it does to plan."

— ELEANOR ROOSEVELT

NORTHWEST E·A·R·T·H INSTITUTE

Northwest Earth Institute
DISCOVER CHANGE, TOGETHER.

Powering a Bright Future

Thank you for your interest in exploring sustainability, and for taking action to address environmental challenges.

You are welcome to print a copy of the *Powering a Bright Future* discussion course for your personal use. However, our copyright permissions do not allow reproductions of this material for anyone other than the person who purchased this electronic copy of our course book.

The NW Earth Institute is a small nonprofit, and we are primarily funded by member contributions and the sale of our course books. We sincerely appreciate your support of our work, and thank you for not distributing this course book.

Please feel free to contact us if you have any questions.

Best Regards,

Lacy Cagle, Curriculum Director, and the NW Earth Institute Staff

Northwest Earth Institute
107 SE Washington St. Ste. 235, Portland OR 97214 • 503.227.2807
www.nwei.org

POWERING A BRIGHT FUTURE

By

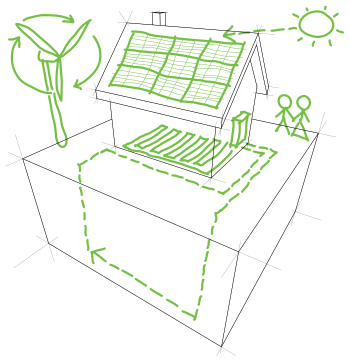
Northwest Earth Institute
107 SE Washington St., Suite 235
Portland, OR 97214
(503) 227-2807
Email: contact@nwei.org
www.nwei.org

NWEI is deeply grateful for the generosity of
Elizabeth Zavodsky, Rob Nathan, Tyler Roppe, Zach Drew,
Mark Lyles, Jeremy Mohr, Michele Bernal-Graves, and Erik Horngren,
who gave their time and expertise to develop this course book.

Layout and Typography: Margaret Parker
Curriculum Development: Lacy Cagle

TABLE OF

CONTENTS



INTRODUCTION

Energy allows mobility, growth, adaptability and development. Access to reliable energy allows children to study after dark, families to heat their homes and refrigerate their food, medical staff to perform life-saving procedures, and businesses to grow and expand. Fossil fuels allow Americans the privilege to live lives of relative ease and mobility. Life without fossil fuels can be difficult to imagine.

Energy can be a very complex and confusing topic, once you start to consider access, security, production, environmental impacts, and all the other related issues. Add climate change to the mix and it becomes politically charged as well. What is the best information available? What are our options for taking action now and planning for the future? How can we all find common ground? The United Nations has declared 2012 to be "The Year of Sustainable Energy for All." But what does sustainable energy mean? What does it look like?

Powering a Bright Future addresses many of the relevant issues surrounding energy and its use, but this discussion course is in no way exhaustive. In fact, it's likely that you will wonder why we don't address a particular energy issue in this course — mountaintop removal, tar sands extraction, and arctic drilling are just a few examples of issues related to energy sourcing that are not covered. This course is not intended to completely cover energy as a topic. It is meant instead to generate interest in energy issues, inspire discussion around solutions, and drive personal learning and action.

With two sessions, *Powering a Bright Future* can be used alone or in combination with our *Global Warming: Changing CO2urse* or *Just Below the Surface: Perspectives on the Gulf Coast Oil Spill* discussion courses. Each session includes readings, questions for the group, a "Putting It into Practice" list of suggested actions and "Further Readings and Resources."

When you meet with your discussion group during these two sessions, we invite you to bring your own experience and critical thinking to the process. The readings are intended to invoke meaningful discussion. Whether you agree or disagree, you will have an opportunity to clarify your views and values.

The course also includes weekly Action Plans to guide you in making personal changes. Each week, group members will choose one action from their Action Plans to implement during the following week. During the next group meeting, participants share the actions they set forth to implement along with their successes and challenges. We also suggest sharing your long-term goals with your group during the optional Celebration session. The Celebration is encouraged as a way for your group to mark the completion of the course, share personal goals and progress, and consider ways the group might continue to work together to create change in the community.

For information on how to start a discussion group, visit www.nwei.org and see the "Course Resources" page. There you'll find flyers, organizing guides and press releases that you can use to convene a group. Included on pages 6-7 of this guide, "How to Start a Discussion Course" provides further information about organizing a course. You may also contact our office at (503) 227-2807. We encourage you to become a member of NWEI and support our efforts to engage new people and communities in creating change for good; please visit www.nwei.org/join or complete the "Become a Member of NWEI" form on page 51 of this guide.

Thank you for participating in the Northwest Earth Institute's discussion course, *Powering a Bright Future*. On behalf of the thousands of organizations, workplaces and volunteers who are involved in promoting Northwest Earth Institute programs, we trust that your experience with this course will be of deep and lasting value.

How to Start a Discussion Course

Thank you for your interest in the programs offered by the Northwest Earth Institute. The following tips are for those of you who would like to organize NWEI discussion groups.

We are thrilled that you have taken the initiative to order this course book for small-group discussion. While this course book has tremendous standalone value, please keep in mind that it was designed to be used with others in a group dialogue setting. As such, we ask that you consider inviting others to participate with you. You can find steps for doing so below. If you have any questions about the process, please visit our website (www.nwei.org) or contact any member of NWEI's Outreach Team at (503) 227-2807, or by email at contact@nwei.org. If you have joined an already formed group, please consider organizing future courses. We hope you benefit from participating in this course.

STEP 1: FORM GROUP(S) — IDEAL SIZE IS 8-12 PEOPLE.

In certain regions, a local NWEI representative may be available to assist you in getting started. Visit www.nwei.org/n_american_network to see a list of regions where NWEI representatives may be available to mentor new groups and offer introductory presentations on NWEI's work and mission.

TIPS FOR STARTING YOUR NWEI COURSE:

- Invite others to join your course via newsletters, email networks, personal invitations or the media. Download NWEI program flyers at www.nwei.org. Include location information, times and dates for the entire program. Set clear registration deadlines for signups.
- Order any remaining materials from NWEI and get course books to participants before the date of the first group meeting.
- Call a noontime meeting or host a brown bag lunch in a workplace to offer an informal presentation on NWEI programs and how they work.
- Host an introductory group meeting at home, your community or faith center, local library or municipal office.
- Visit www.nwei.org/course_resources to download the Course Organizer's Guide for additional tips and resources..

STEP 2: BEFORE THE FIRST SESSION

- Get course books to participants well in advance of the first meeting. Make sure to ask participants to complete the first reading/action plan assignment before they come to the first session.
- As the course organizer, you should plan to serve as the facilitator for the first session.
- Recruit one of the course participants to serve as the first session opener.

STEP 3: FIRST SESSION — GETTING STARTED

TAKE THE FOLLOWING MATERIALS WITH YOU TO THE FIRST SESSION: 1) Course book, 2) Course schedule on page 7 for participants to sign up for opener, facilitator, and notetaker roles for the remaining sessions.

HAVE A ROUND OF INTRODUCTIONS. Introductions serve several important functions, even if the group is already well acquainted. Participants begin to know each other on a personal level and have an opportunity to "get each person's voice into the room." A person who has spoken and been listened to early in the session is more likely to participate in the rest of the session. Ask participants to say their names and something personal about themselves. As the organizer of your group, you should give your answer first to model the length and content.

DESCRIBE THE GROUP PROCESS. NWEI programs are designed to encourage discussions that clarify personal values and attitudes. Consensus is not the goal, and the group should not seek to reach agreement at the expense of diversity of opinion. Most groups meet for an hour to an hour and a half for each meeting. Each session will be led by a facilitator from the group. Point out the "Guidelines for the Facilitator, Opener and Notetaker" on page 8.

DISTRIBUTE THE REGISTRATION FORM or email participants the link to NWEI's online registration form to ensure you have complete and current contact information for all participants. If using the paper registration form, please scan it and email to contact@nwei.org or mail it to us at the address on the form. You may wish to keep a copy for future correspondence with participants.

CALL ATTENTION TO THE EVALUATION FORM. Encourage participants to fill out the evaluation form on page 9 and share their feedback with NWEI. They can do this by mailing the form to us or by completing our online evaluation form, available at www.nwei.org.

FILL OUT THE COURSE SCHEDULE (found on the next page). This gives different group members an opportunity to sign up to present an opening, to facilitate, and to take notes. Information on opening, facilitating and taking notes is included at the beginning of each course book.

STEP 4: FIRST SESSION — DESCRIBE/PRESENT THE OPENING

Please reference "Guidelines for the Facilitator, Opener and Notetaker" located on page 8.

STEP 5: FIRST SESSION — FACILITATING THE DISCUSSION

EXPLAIN THE ROLE OF THE FACILITATOR, OPENER AND NOTETAKER. Tell the group that you will help keep the discussion personal, focused, and balanced among the participants. Show them the "Guidelines" on page 8. Encourage each person to review these before taking their turn at facilitation, opening or taking notes.

CIRCLE QUESTION. Following the opening, the first step is for each person to answer the Circle Question found at the beginning of each session. The question provides a focus for the day's discussion.

STEP 6: FIRST SESSION — CLOSING

Watch the time, and stop discussion a few minutes before the session is scheduled to end. Note whether the Course Schedule is completed. If it is not, work with participants to complete it. Confirm the time and place for the next meeting. Be sure to end the class on time. This shows respect for the participants, and demonstrates that their time commitment is predictable.

STEP 7: DURATION OF NWEI PROGRAM

Your group will meet two to eight times, depending on the course chosen and on the meeting dates set by participants. Each session will be led by a rotating member of the group. Note the "Putting It into Practice" and "Further Reading" lists at the beginning of each session for ideas on further educational opportunities, as well as tips for applying the learning into your life.

CLOSING

FINAL SESSION — CELEBRATION. The final session in each discussion guide is an optional celebration, and is an opportunity to:

- Celebrate the completion of the program and evaluate your experience.
- Discuss options for continuing as a group, reflect on actions taken during the course and consider goals and action items to implement.
- Consider organizing other NWEI programs in your community, workplace or organization.

Don't hesitate to contact NWEI for assistance with questions.

COURSE SCHEDULE FOR POWERING A BRIGHT FUTURE

This course schedule may be useful to keep track of meeting dates and of when you will be facilitating, providing the opening, or taking notes.

Course Coordinator : _____ Phone :_____

Mentor (if applicable): _____ Phone :_____

Location For Future Meetings :_____

CLASS SESSION	DATE	OPENER	FACILITATOR	NOTETAKER
The Big Picture: Shedding Light on Energy				
How to Plug In				
			PLANNERS	
Celebration*				

*After the last regular session, your group may choose to have a final meeting and Celebration. This meeting celebrates the completion of the course, and may include a potluck lunch or dinner. It is an opportunity for evaluation and consideration of next steps.

GUIDELINES

FOR THE FACILITATOR, OPENER AND NOTETAKER

For each session of this course, one participant brings an "opening," a second participant facilitates the discussion , and a third participant takes notes on each person's commitment to action. The roles rotate each week with a different group member doing the opening and facilitating. This process is at the core of the Earth Institute culture — it assumes we gain our greatest insights through self-discovery, promoting discussion among equals with no teacher.

✦ ✦ ✦

FOR THE SESSION FACILITATOR

As facilitator for one session, your role is to stimulate and moderate the discussion. You do not need to be an expert or the most knowledgeable person about the topic.

Your role is to:

- Remind the designated person ahead of time to bring an opening.
- Begin and end on time.
- Ask the questions included in each chapter, or your own.
- Make sure your group has time to talk about their commitments to action — it is a positive way to end each gathering.
- Keep discussion focused on the session's topic. A delicate balance is best — don't force the group into the questions, but don't allow the discussion to drift too far.
- Manage the group process, using the guidelines below:

  A primary goal is for everyone to participate and to learn from themselves and each other. Draw out quiet participants by creating an opportunity for each person to contribute. Don't let one or two people dominate the discussion. Thank them for their opinions and then ask another person to share.

  Be an active listener. You need to hear and understand what people say if you are to guide the discussion effectively. Model this for others.

  The focus should be on personal reactions to the readings — on personal values, feelings, and experiences.

  The course is not for judging others' responses. **Consensus is not a goal.**

The facilitator should ensure that the action item discussion:

- allows each person's action item to be discussed for 1-2 minutes;
- remains non-judgmental and non-prescriptive;
- focuses on encouraging fellow group members in their commitments and actions.

FOR THE SESSION OPENER

- Bring a short opening, not more than a couple of minutes. It should be something meaningful to you, or that expresses your personal appreciation for food or the natural world. Examples: a short personal story, an object or photograph that has special meaning, a poem, a visualization, etc. We encourage you to have fun and be creative.
- The purpose of the opening is twofold. First, it provides a transition from other activities of the day into the group discussion. Second, since the opening is personal, it allows the group to get better acquainted with you. This aspect of the course can be very rewarding.

FOR THE NOTETAKER

At the end of each session, each participant will commit to one action item they will complete before the next meeting. They will share their action with the group, and it is your responsibility as notetaker to record each person's commitment to action.

Each week the notetaker role will rotate. During the portion of discussion focused on action items, the notetaker from the previous meeting will read aloud each person's action item, and group members will have the opportunity to share their successes and struggles in implementing their actions. The new notetaker for that week will then record each person's commitment for the next meeting.

For more information on the NWEI process and organizing a course, see "How to Start a Discussion Course" on page 6.

EVALUATION

PART 1. PLEASE FILL OUT WEEKLY. Rate the two sessions.

	POOR CHOICE ····· EXCELLENT					COMMENTS:
1. The Big Picture Shedding Light on Energy	1	2	3	4	5	
2. How to Plug In	1	2	3	4	5	

Were the following articles helpful? Circle "Y" if we should use the article next time or "N" if we should look for better reading material. Leave blank if you didn't read it or have no opinion.

COMMENTS:

1. The Big Picture: Shedding Light on Energy
   - Making Sense of Peak Oil and Energy Uncertainty..... **Y N**
   - Solar Power Off the Grid Energy Access for World's Poor.... **Y N**
   - Complications and Consequences of Fossil Fuel Extraction ..... **Y N**
   - Fracking Democracy..... **Y N**
   - Would the World Be Better Off Without Nuclear Power?..... **Y N**
   - Scrapping Fossil-Fuel Subsidies Would Get Us Halfway There on Climate Change ..... **Y N**
   - Climate Proposal Puts Practicality Ahead of Sacrifice ..... **Y N**
   - U.S. Carbon Emissions Down 7 Percent in Four Years: Even Bigger Drops Coming..... **Y N**

1. How to Plug In
   - Peak Oil: A Chance to Change the World ..... **Y N**
   - Henry Red Cloud: Solar Warrior for Native America ..... **Y N**
   - Excerpts from "Energy Efficiency" ..... **Y N**
   - Low-Carbon Food Tips ..... **Y N**
   - Why 16 Year-Old Alec Loorz is Suing the Government ..... **Y N**
   - Is Climate Change a Big Deal and Caused by Humans? ..... Y N

PART 2. PLEASE COMPLETE AT END OF COURSE.

Has the course made a difference in your life? Yes No Please describe what actions you are taking or you plan to take in response to this course. _____

_____

_____

_____

continued

Please list other articles or books that should be included in the course. Identify chapter(s)/page(s) and the session where they should be included. _____

_____

_____

_____

_____

What has been the most valuable aspect of this course?_____

_____

_____

_____

_____

Please send your completed evaluation to NWEI, 107 SE Washington St., Suite 235, Portland, OR 97214. Thank you for your participation!

Course Participant Registration Form

PLEASE RETURN ONE FORM PER GROUP TO NWEI FOLLOWING YOUR FIRST SESSION. Why does NWEI need this information? In order to keep accurate participant records and for grant reports. **This information is for NWEI use only, and is not shared with any other organization.**

The Course Organizer should have everyone in your group add their information, and return the form to NWEI after your first session. You can return the form via mail, email or fax — see below. Thank you!

COURSE ORGANIZER'S NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

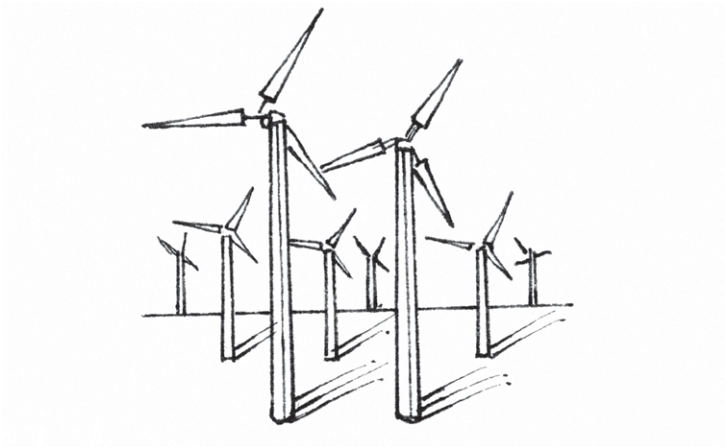
NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

NAME:
ADDRESS:
CITY, STATE, ZIP:
PHONE (H): PHONE (W):
E MAIL:

COURSE START DATE/FIRST MEETING DATE:
MEETING TIME:
COURSE NAME:
MENTOR (IF APPLICABLE):
TYPE OF GROUP [HOME, COMMUNITY, BUSINESS, GOVERNMENT, NON-PROFIT]:
NAME & ADDRESS OF MEETING PLACE:

Mail to NWEI 107 SE Washington St., Suite 235, Portland, OR 97214; fax to 503-227-2917 or scan and email to contact@nwei.org.

Thank you very much for helping us accurately track participation in NWEI programs. We greatly appreciate your prompt attention in returning this form as soon as possible after your course begins.



THE BIG PICTURE: SHEDDING LIGHT ON ENERGY

"Most people spend more time and energy going around problems than in trying to solve them."

— HENRY FORD

SESSION GOALS

- **To get acquainted, and to set personal and group goals for the course.**
- **To establish a basic understanding of energy sources and end uses.**
- **To explore the big picture of energy — including use, extraction, equity, sustainability and uncertainty, policy, and connections to climate change.**
- **To commit to action around energy issues.**

SESSION BACKGROUND

The content in this session provides a broad overview of the big picture of energy — from the twin issues of energy uncertainty and climate change, to renewable energy options and other innovative approaches to addressing these problems.

SUGGESTED GROUP ACTIVITY

Before the first group session, find out what organizations in your community are doing to promote renewable energy. How can you get involved? Refer to the additional suggested resources on our website for ideas: www.nwei.org/powering-a-bright-future/resources

FURTHER RESOURCES

Interested in finding out more on the topics presented in this session? Visit our website for further readings and resources: **www.nwei.org/powering-a-bright-future/resources**

Join our Facebook page to continue the discussion online: **www.facebook.com/northwestearthinstitute**

Circle Question

Think outside the grid: how can you more effectively use the energy of the sun in your life?

Circle questions should move quickly — each member responds briefly without questions or comments from others. Facilitator guidelines are on page 8.

SUGGESTED DISCUSSION QUESTIONS

1. **After reading "Making Sense of Peak Oil and Energy Uncertainty," we have a broader idea of oil's ubiquity in our society. Have you experienced energy uncertainty in your own life? What steps can we be taking now to plan for the future, with regard to energy security, sustainability, and addressing climate change?**
2. **Carl Pope discusses how the world's poorest, who don't have access to electricity, pay for light through kerosene use. How are the poorest indirectly paying for electricity even though they may not receive access to it? What energy costs are hidden in the average U.S. citizen's bills?**
3. **What is your city, county, state or other local government doing to mitigate climate change and/or the energy crisis? Are you doing what is needed as a local citizen to support a climate action plan?**
4. **Were you aware of the environmental concerns of hydraulic fracturing or "fracking" before reading Sandra Steingraber's "Fracking Democracy"? What are your thoughts on fracking now?**
5. **Do you think the world would be better off without nuclear energy? Why or why not?**
6. **What are the pros and cons of getting rid of fossil fuel subsidies?**
7. **How can you find common ground with people who think differently than you to work toward a better and more sustainable energy future?**
8. **The Lester Brown article offers hope for a change in our energy habits in the U.S. What other signs of hope can you think of? What are the next steps or new commitments you can take to continue our emission decline?**

PUTTING IT INTO PRACTICE

- Learn the sources of your household energy. Consider ways to reduce your dependence on fossil fuels. Examples include line-drying your clothes, installing solar panels, or choosing a renewable energy option from your power company.
- Get involved with your local Transition movement (http://www.transitionus.org/) or another organization campaigning for clean energy policy.
- Go on a carbon diet: pick one area of energy consumption — transportation, food, heating are all good examples — and take steps to significantly reduce your carbon footprint in that area.

DEFINITION OF TERMS

Fossil fuels are formed by the decomposition of plant and animal matter from millions of years ago. The three primary fossil fuels are coal, oil and natural gas. When burned to produce energy, these fuels emit CO_2, which can lead to global warming and associated climate changes when atmospheric concentrations of CO_2 increase past a certain point. Fossil fuels currently account for 80% of the world's energy use.

Natural gas is a type of fossil fuel that is primarily composed of methane. It emits CO_2 when burned, but produces less CO_2 than oil or coal. It also produces far less carbon monoxide, nitrogen oxides, sulfur dioxides, particulates and mercury (all compounds with potential health hazards) than oil or coal. However, the primary method of natural gas extraction, fracking, carries its own potential risks.

Fracking (short for "Hydraulic Fracturing") is a practice used to extract natural gas from deep underground. Wells are drilled up to 10,000 feet below the earth's surface and then pumped at a high pressure with a combination of water, sand, and chemicals. The result is a cracking of the rock and the release of natural gas. The process uses millions of gallons of water and poses a potential threat to aquifers and safe drinking water due to the numerous chemicals, which are currently unregulated, used to aid extraction.

SESSION 1 ACTION PLAN: THE BIG PICTURE

After completing the readings for this week, take some time to consider actions you can take to live more intentionally and purposefully.

The "Putting It Into Practice" section and example boxes below can get you started with ideas.

For each category:

1. **Identify** current habits and behaviors you would like to change.
2. **Brainstorm** new habits. Be sure to be realistic, yet challenging.
3. **Select one** change you will make before your group meets again.

*Commit to one specific change this week, and begin to add more changes into your life as time goes on. This is an ongoing process.

Category	Identify	Brainstorm	Select One
Energy Efficiency In what ways can you reduce unnecessary energy consumption in your own life?	We leave our porch lights on 24 hours a day.	Install a motion sensor light with an LED bulb. Install solar-powered walk lights.	

Category	Identify	Brainstorm	Select One	Timeline / Completion
Energy Efficiency In what ways can you reduce unnecessary energy consumption in your own life?				
Renewable Energy How can you promote renewable energy research, production or use in your own life? In your community?				
Your Choice In what other ways can you take action to address your own most pressing energy issues?				

*To see how others have implemented some of these ideas into their daily lives, check out our blog at http://blog.nwei.org and the EcoChallenge website at www.ecochallenge.org.

MAKING SENSE OF PEAK OIL AND ENERGY UNCERTAINTY

By Daniel Lerch

For more than sixty-five years we have designed our communities for oil. We've built nearly 47,000 miles of high-speed interstate highways, a vast continental network for fueling and servicing gasoline-powered vehicles, and millions of acres of car-dependent suburbs. This gargantuan legacy of long-term investments has all been made with the assumption that the petroleum fuels that make the whole system work will be available for the foreseeable future.

But global trends of oil supply and demand are changing to such a degree that this assumption is no longer realistic. Far more than a problem of higher prices at the pump, the quickly emerging new energy reality has enormous implications for just about every aspect of our lives. Forward-thinking households, businesses, and governments are now rushing to plan for an unprecedented energy crisis, the first phases of which we are already experiencing.

What lies behind this twenty-first-century energy crisis? Why can't we rely on the market to fix a problem that is ultimately about supply and demand? To make sense of what's going on, we first need to understand some of the basics of how we harness and use energy and the limitations of the various energy resources available to us.

SUPPLY AND DEMAND

Our supply of cheap, easy-to-extract "conventional" oil, from places like the flat plains of Texas and the deserts of Saudi Arabia, is at or near permanent decline; the remaining "unconventional" oil, from places like the tar sands of Canada and the depths of the Gulf of Mexico, is increasingly difficult to find, extract, and refine. At the same time, global demand for petroleum is sky-high at 85 million barrels per day — twice as much as in 1969. That's a lot of oil to keep pouring in to the pipelines to meet "business-as-usual" needs, let alone to meet new demand from growing countries like China and India.

With the conventional oil dwindling and the unconventional oil that's replacing it increasingly problematic, there will inevitably come a point at which the flow of oil from the wells and the refineries will simply be unable to keep up with global demand. The point at which total global oil production cannot grow any further and begins its permanent decline is known as "peak oil," a term that was hardly known outside the petroleum geology field as recently as 2004 but is rapidly attracting attention and concern. A growing number of analysts and government agencies are acknowledging that we will have reached peak oil by 2015, if we haven't reached it already.

A BIG PROBLEM

None of this would be a real concern if the product in question were a market commodity like soybeans or pork bellies: Demand and supply would find a new equilibrium without fundamentally threatening the global economy. Oil, however, is unlike any other commodity in four important ways.

First, oil is absolutely essential to the most basic functions of the industrialized world. Oil is the key raw material for gasoline, diesel, jet fuel, home heating oil, industrial oils, many chemicals, and most plastics. Many key industries are wholly dependent on oil in multiple forms; for example, the modern global system for producing and distributing food uses oil as a fuel for farming and transportation and as a raw material for agrochemicals. Instability in oil supply and price has serious potential consequences for virtually all sectors of the global economy, particularly transportation, agriculture, and manufacturing.

Second, there are currently no viable substitutes for oil at current rates of consumption. Although alternatives to oil do exist for many of its uses, they are generally vastly inferior to oil in their energy content and in the ease with which they can be extracted, transported, and turned into a commercially usable fuel. "Net energy" or "energy returned on (energy) invested (EROI) refers to the ratio between the energy expended to harvest an energy source and the amount gained from that harvest. All alternative fuels have

worse EROIs than conventional oil, and some have such poor net energy that they are practically useless to manufacture. Even other conventional energy sources — especially coal, natural gas, hydropower, and uranium — face serious constraints as potential replacements for oil as our dominant fuel.

Third, the modern world's complex interfirm and intergovernmental economic relationships, made up of movements of raw materials and goods across the globe, very much depend on the price and availability of oil being relatively predictable. If the price of oil becomes very high or very volatile, or both, the globalized economy as a whole will face fundamental challenges. Indeed, the threat of peak oil is already creating change and uncertainty in diverse sectors of the global economy: As oil prices surged above fifteen-year highs after 2004, beef prices rose rapidly in part because the high energy prices (together with new federal subsidies) spurred farmers to sell more corn to ethanol producers and less to cattle feedlots — a chain of events that few predicted. More worryingly, during the oil price spike of 2008 it became apparent that much of the airline industry simply can't survive in a world where oil costs $110 or more per barrel.

Finally — and in part a result of the previous three qualities — oil is such an intrinsic part of how our world works that Adam Smith's "invisible hand" of the market is simply unable to deal adequately with the threats posed by peak oil. As a 2005 report on peak oil for the U.S. Department of Energy observed:

Mitigation will require a minimum of a decade of intense, expensive effort, because the scale of liquid fuels mitigation is inherently extremely large. . . . Intervention by governments will be required, because the economic and social implications of oil peaking would otherwise be chaotic.

Modern oil projects take a lot of money (billions) and a lot of time (years) to get from exploration to oil heading to the refinery. As oil prices go up, markets (and oil-producing countries) respond by putting more money into exploration and production. But the combination of the exploration-to-production lag time, the enormous financial risks on big unconventional-oil projects, imperfect information on international oil reserves, and other factors means that the private sector has not yet seen the incentives (and, indeed, may never see them) to respond at a sufficient scale to the multifaceted threats posed by peak oil.

Have you considered the carbon footprint — and climate impact — of everyday items in your life? Here are estimates of the CO2 emitted by some common items and actions. In what other ways do we typically overlook the embedded energy and carbon impact of our choices?

Are there steps you could be taking to save energy and reduce your footprint?

Item	CO2 Emissions
Bottle of Water (16 oz.)	160g
A Letter	200g
Small Catalog	1,600g
Driving 1 Mile	850g
1 ton of Fertilizer	2.7 tons
1 ton of Fertilizer Used in Excess	12.3 tons
World Average Person	7 tons per year
Average American	28 tons per year

CO2 Emission data from: "How Bad are Bananas: The Carbon Footprint of Everything" by Mike Berners-Lee

Clearly, peak oil is much, much more than a problem of higher fuel prices. In Post Carbon Cities, I used the term "energy uncertainty" to collectively describe the wide and growing range of economic and social uncertainties that are being driven by peak oil. In a similar way, global warming is driving a wide and growing range of economic, social, and of course environmental uncertainties, which I collectively termed "climate uncertainty." "Energy and climate uncertainty" is an important joint frame for understanding and approaching these two crises because our responses to one inevitably affect the other.

Daniel Lerch is program director of Post Carbon Institute and the author of *Post Carbon Cities: Planning for Energy and Climate Uncertainty* (2007). He has delivered presentations and workshops on local responses to peak oil to elected officials, planners, and other audiences across the United States, as well as in Canada, the British Isles, and Spain. This reading is an excerpt from his chapter on "Making Sense of Peak Oil and Energy Uncertainty" in *The Post Carbon Reader: Managing the 21st Century's Sustainability Crises* (2010), published by Post Carbon Institute.

"Everyone is entitled to his own opinions, but not to his own facts."

— SENATOR PAT MOYNIHAN

Renewable Energy

Sustainable sources that use nature to regenerate well into the future and are also called green, clean or alternative forms of energy

SOURCE				
SOLAR	BIOMASS	WIND	GEOTHERMAL	HYDROPOWER
Emanates from the sun's solar rays to generate heat or electricity	Stored energy in non-fossilized, plant-based materials like wood and biofuels	Uses turbines to capture the kinetic energy produced by wind	Derived from heat in the Earth's core forming steam or hot water	Comes from the flowing of water through turbines and is the most used renewable energy source
NEAR ENDLESS POTENTIAL				
Over 7,500 times the world's yearly energy consumption beams down annually	Currently supplies about 10% of global energy demand but output could increase 10 fold by 2050	Complicated to measure, but possibly 5 times of the world's total energy use could be captured via wind	Although capturing can be a challenge, the Earth puts off enough heat to power the world 3 times over a year	Only a fraction of potential has been developed and could meet over 10% of the world's total energy needs
PROS				
Uses our most plentiful energy source, is flexible to scale so that even individuals can provide their own power and aligns with peak loads	Can be domestically produced and offers the transportation system a cleaner burning fuel compared to fossil fuels	Very sustainable form of energy that has low maintenance and operation costs, making it comparable to the cost of a coal plant	Flexible in application and can be applied in both small- and large-scale environments	Has low overall cost with a long plant life, provides constant energy flow and can create recreation areas
ONLY A FRACTION OF U.S. CONSUMPTION AT 8% TOTAL				
1%	53%	11%	3%	31%
CONS				
Considered one of the more costly energy options, isn't very reliable and additional transmission infra-structure is often needed	Still produces greenhouse gasses and can redirect agricultural activities away from food production, increasing food costs	Can require expansive distribution infra-structure due to the location of wind centers, lacks reliability and has the potential to affect wildlife	Potential environmental dangers due to drilling, and areas of heat can change	Can drastically affect river ecology by changing flow, blocking passage, altering water temperature, etc.

Information compiled from EIA International Energy Outlook 2011, EIA Annual Energy Review 2010, EnergyLiteracy.org, Focus the Nation's *Watt?* 2011

Nonrenewable Energy

Limited sources of energy that nature can't quickly or can't ever restore

SOURCE			
OIL	COAL	NATURAL GAS	NUCLEAR
Developed in ocean beds from ancient plants and animals that were covered with silt and sand more than 300 million years ago	Combustible sedimentary rock formed from heat and pressure applied to plants that died 300 million years ago	Created from the same process as other fossil fuels, but in areas where heat and pressure weren't as dominant to contain it	Process of splitting atoms commonly derived from uranium to release energy in the form of heat and light
LIMITED OUTLOOK			
While an extremely controversial topic, with some hoping tar sands can be a long-term solution, officials estimate we have around 40 years of oil usage left	128 years of mining are left at current rates of use	Changeable based upon new discoveries that have drastically increased reserves the last couple decades, the reserves-to-production ratio is said to be around 60 years	Current uranium supply should last 80 years although more could be uncovered
PROS			
Easily transported, well established, fairly cheap, widely available and high energy yield	Can be the cheapest energy option, is easily available and is extremely well established to generate electricity	Burns cleaner than other fossil fuels, has well-established infrastructure and is available domestically	Deemed mostly environmentally friendly when used for the generation of electricity
STILL DOMINATES U.S. ENERGY CONSUMPTION			
37%	21%	25%	9%
CONS			
Must rely on foreign sources, is limited in supply, can pose significant environmental impacts to obtain and contributes greatly to global warming	Considered the worst environmentally of all fossil fuels when burned, and power plants have to constantly run even if demand is low	Produces greenhouse gases even if it is cleaner than other fossil fuels, is still a limited resource with dynamic price indexing, and extraction can be environmentally damaging	Has long permitting process, there are still concerns over public safety, and offers no clear solution for safe storage of large amounts of nuclear waste storage

SOLAR POWER OFF THE GRID: ENERGY ACCESS FOR WORLD'S POOR

By Carl Pope

More than a billion people worldwide lack access to electricity. The best way to bring it to them — while reducing greenhouse gas emissions — is to launch a global initiative to provide solar panels and other forms of distributed renewable power to poor villages and neighborhoods.

After the Durban talks last month, climate realists must face the reality that "shared sacrifice," however necessary eventually, has proven a catastrophically bad starting point for global collaboration. Nations have already spent decades debating who was going to give up how much first in exchange for what. So we need to seek opportunities — arenas where there are advantages, not penalties, for those who first take action — both to achieve first-round emission reductions and to build trust and cooperation.

One of the major opportunities lies in providing energy access for the more than 1.2 billion people who don't have electricity, most of whom, in business-as-usual scenarios, still won't have it in 2030. These are the poorest people on the planet. Ironically, the world's poorest can best afford the most sophisticated lighting — off-grid combinations of solar panels, power electronics, and LED lights. And this creates an opportunity for which the economics are compelling, the moral urgency profound, the development benefits enormous, and the potential leverage game changing.

The cost of coal and copper — the ingredients of conventional grid power — are soaring. Meanwhile, the cost of solar panels and LEDs, the ingredients of distributed renewable power, are racing down even faster.

If we want the poor to benefit from electricity we cannot wait for the grid, and we cannot rely on fossil fuels. The International Energy Agency, historically a grid-centric, establishment voice, admits that half of those without electricity today will never be wired. The government of India estimates that two-thirds of its non-electrified households need distributed power.

Fortunately, the historic barriers to getting distributed renewable power to scale in poor villages and neighborhoods are rapidly being dismantled by progress in technology, finance, and business models. Getting 1.2 billion people local solar power they can afford is within grasp — if we only think about the problem in a different way. In fact, the world can finish this job by 2020.

The poor already pay for light. They pay for kerosene and candles. And they pay a lot. The poorest fifth of the world pays one-fifth of the world's lighting bill — but receives only .1 percent of the lighting benefits. Over a decade, the average poor family spends $1,800 on energy expenditures. Replacing kerosene with a vastly superior 40 Wp (Watts peak) home solar system would cost only $300 and provide them not only light, but access to cell-phone charging, fans, computers, and even televisions.

Kerosene costs 25 to 30 percent of a family's income — globally that amounts to $36 billion a year. The poor do not use kerosene because it is cheap — they are kept poor in significant part because they must rely on expensive, dirty kerosene.

And the poor pay in other ways. A room lit by kerosene typically can have concentrations of pollution 10 times safe levels. About 1.5 million people, mostly women, die of this pollution every year, in addition to those who die from burns in fires.

So why do the poor use kerosene? Because they can buy a single day's worth in a bottle, if that is all they can afford. For the poor, affordability has three dimensions: total cost, up-front price, and payment flexibility. Solar power comes in a panel that will give ten, or even 20, years of light and power — but the poor cannot afford a ten-year investment up front. And many cannot handle conventional finance plans, which require fixed payments regardless of their income that month.

Nor, for the record, do the electrified middle class pay for electricity up front. When I moved into my house in San Francisco, I did not get a bill for my share of the power plants and transmission grid that give me power each month. I pay as I go, based on how many kwh's I use that month.

So lighting the lives of 1.2 billion people with off-grid

renewable electricity requires three ingredients:

- Capital to pay for solar or other renewable electrical generation for 400 million households that depend on kerosene;
- Business models for those households to pay for the electricity they use, at the price it really costs, which is a lot less than kerosene;
- Financing, public policy, and partnerships to create the supply chains and distribution networks capable of getting distributed electrical systems to every household that needs them. (These needs might require $6 billion in credits and loan guarantees.)

The money is on the table. It's just on the wrong plates. Purchase and finance of solar power for 1.2 billion people would cost about $10 billion a year over a decade. The 11 countries with the largest number of households without electricity spent $80 billion each year subsidizing fossil fuel — only 17 percent of which benefits the poor. In 2010, the World Bank spent $8 billion on coal-fired power plants, few of which provided meaningful energy access to the poor. The UN's Clean Development Mechanism is proposing to give $4 billion a year to anything-but-clean coal-plants. So there is already far more capital in the system than is needed.

Even five years ago the business models did not exist to enable the poor to afford solar. Solar was much more expensive. The only alternative to buying a solar system with cash was a bank or micro-credit loan for which most of the poor could not qualify.

But the combination of dirt-cheap solar, the cell-phone revolution, and mobile phone banking has changed everything. There are almost 600 million cell-phone customers without electricity — using their phones very little, still spending $10 billion to charge them in town. There are hundreds of thousands of rural, off-grid cell towers powered by diesel — at a price of about $0.70/kilowatt hour. All over the world cell-phone towers are being converted from diesel to hybrid renewable power sources. So cell phone companies have a powerful motivation to get renewable power into rural areas, to get electricity to their customers, and to charge for electricity through their mobile phone payment systems.

At least three commercial models have been launched in the last several months. India's Simpa Networks — in partnership with SELCO in India and DT-Power in Ghana, India and Kenya — are testing models in which solar distributors can allow customers to pay for electricity through mobile banking "pay as you go" plans. Zimbabwe's *Econet Power* has launched an even more intriguing model, in which it provides its cell-phone customers with solar power as a customer benefit, charging them only $1 week to use a home solar system provided by Econet, with the bills tied to the customer's cell phone account.

UN Secretary General Ban Ki-moon has proclaimed 2012 the Year of Universal Energy Access. His initiative is keyed not to the UN climate talks, but to the Rio +20 Earth Summit talks scheduled for June.

Imagine that at Rio, instead of embracing business-as-usual solutions to energy access, the world decided to empower the poor with the electricity they can truly afford — distributed solar?

What would the benefits be? In carbon terms alone, kerosene for lighting emits almost as much greenhouse-gas pollution as the entire British economy. 1.5 million lives a year would be saved from respiratory ailments. The available income for the world's poorest fifth would be increased by 25 to 30 percent — a pretty big development bang-for-the-buck. Numerous studies have shown that providing basic energy access increases household income by 50 percent or more by providing more time and opportunities for home-based income generation.

But the leverage is actually much greater. If one-fifth of the world is on solar, as these people prosper and can afford more electricity, they are going to expand solar systems, rather than turning to coal or nuclear. Their neighbors include the one-third of humanity with "spasmodic" electricity — wires that in rural areas work only at night, and in urban areas go down in the afternoon. These customers would find distributed solar far more reliable than the current grid. If we add those 2 billion to the 1.2 billion who are not on the grid, virtually half of humanity could be turning to renewable power as the cheapest, most reliable and most available form of energy. The fossil fuel interests would lose completely their current moral argument — that more carbon will power the poor.

That, I would argue is a phenomenal game-changer — and a powerful first step in building a trusting, low-carbon coalition of rich and poor nations. And that coalition could lay the groundwork for the more challenging global efforts that will be needed to stabilize and eventually restore the climate.

Carl Pope, chairman and former executive director of the Sierra Club, has served on the boards for the National Clean Air Coalition, California Common Cause, and Public Interest Economics Inc. Pope co-wrote the book *Strategic Ignorance: Why the Bush Administration Is Recklessly Destroying a Century of Environmental Progress*, which was published in 2004. This article was originally published by Yale Environment 360. http://e360.yale.edu

COMPLICATIONS AND CONSEQUENCES OF FOSSIL FUEL EXTRACTION

By Lacy Cagle

As we run out of easily accessible supplies of fossil fuels, innovative energy producers have found new — and often dangerous — ways of extracting more difficult-to-reach fossil fuels from the Earth: deep ocean drilling, mountaintop removal coal mining, hydraulic fracturing, and tar sands crude extraction are a few examples. These relatively new methods of getting hard-to-reach coal, oil or gas deposits literally rip apart the Earth, polluting ground water and private wells, destroying delicate ecosystems, and uprooting entire human communities. In her article "Fracking Democracy," Sandra Steingraber tells the story of her experience presenting and listening to other folks present to the EPA's Hydraulic Fracturing Public Informational Meeting over the course of two days in Binghamton, New York. Her community is just one of many that are threatened or have already been severely affected by new high-risk methods of resource extraction.

For more information about the complications and consequences of high-risk fossil fuel extraction and what you can do about it, visit our website at www.nwei.org/powering-a-bright-future/resources and check out these resources:

Coal River Mountain Watch: www.crmw.net/

Coal River Mountain's stated mission is "to stop the destruction of our communities and environment by mountaintop removal mining, to improve the quality of life in our area and to help rebuild sustainable communities."

Mountain Justice: www.mountainjustice.org

Mountain Justice demands an abolition of mountain top removal, steep slope strip mining and all other forms of surface mining for coal. They work with other organizations to create diverse and sustainable economies in Appalachian regions traditionally dominated by the coal industry by supporting businesses, jobs and ways of living that are not environmentally or culturally destructive and are nourishing to the social and biological fabric of healthy communities.

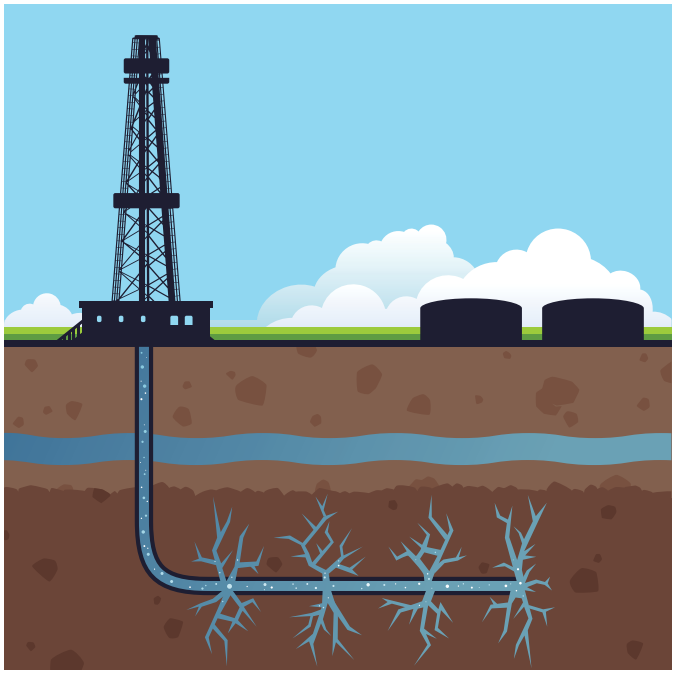
Gasland: www.gaslandthemovie.com/

When filmmaker Josh Fox was offered $100,000 for the gas rights to his family's property in Pennsylvania, he became curious about the possible effects of drilling. Fox decided to talk to other property owners about what he could expect, and their answers were surprising -- many households have discovered their water is not only undrinkable after gas drilling, it's even flammable. Fox traveled to 34 states and talked to dozens of property owners and environmental experts about the dangers fracking and how it has affected them. The website for the film includes fracking FAQs and resources for taking action.

Just Below the Surface: Perspectives on the Gulf Coast Oil Spill: www.nwei.org/discussion_courses/course-offerings/just-below-the-surface

Just Below the Surface is a one session discussion course developed by NWEI that explores the connections between the Deepwater Horizon oil spill, energy policies and our lifestyles. The course offers an opportunity to reflect further on this historical event and the lessons it holds for us moving forward — individually and collectively. The intent is not to assign blame, but rather to take responsibility — as conscious consumers and concerned, active citizens.

Lacy Cagle is the Director of Curriculum and Community Engagement at the Northwest Earth Institute (www.nwei.org). She is also Executive Director of the Zahniser Institute (www.zahniserinstitute.org), which seeks, through education, engagement and research, to promote ways of being, knowing and acting that honor and lead to health and well-being for all of creation.



FRACKING DEMOCRACY
A two-day spectacle carved into two-minute chunks

By Sandra Steingraber

The EPA's Hydraulic Fracturing Public Informational Meeting was probably the strangest exhibition of performance art ever to grace the stage of the Broome County Forum Theater in Binghamton, New York.

Over the course of two days, a panel of EPA officials heard four hundred two-minute presentations by members of the public who had come to advise the agency, at its own invitation, on how it should design a scientific study. As ordered by Congress, this study will investigate the risks to drinking water posed by the Johnny-come-lately technology known as *high-volume slick water horizontal hydrofracturing*, which does to shale bedrock what mountaintop removal does to an Appalachian mountaintop: blows it up to get at a carbon-rich fossil fuel trapped inside.

In the case of fracking, the quarry is methane bubbles trapped inside impermeable layers of shale thousands of feet below the earth's surface. To liberate the gas, millions of gallons of fresh water (high-volume) are mixed with sand and chemicals — some of which are carcinogens — and this slippery mixture (*slick water*) is forced, under immense pressure, into mile-long tunnels drilled sideways (*horizontal*) through bedrock. With the assistance of explosives, this poisonous solution shatters the shale (*hydrofracturing*) and releases a vaporous froth of petroleum, euphemistically known as natural gas, which floats up the borehole — along with brine, radioactive materials, and heavy metals.

So, last September in Binghamton, some four hundred members of New York State's citizenry signed up to express their particular views on the question of how one might go about studying the environmental impacts of this sort of energy extraction. The EPA panelists sat in chairs on the commodious stage of this tattered-but-grand former vaudeville house, while, one by one, each preregistered citizen advisor approached a podium in the orchestra pit and offered up opinions. After 120 seconds, the microphone turned off automatically, ending the presentation of a sometimes still-talking, still-gesticulating petitioner.

Then the next person on the roster was called to the mike. And then the next. And then the next. For four solid hours. And then the panelists took an intermission and came back for another four-hour round of two-minute testimonies. And then there was a second day of speeches.

For members of the audience, who could see only the back of the speaker as he or she addressed the onstage panel, the sole visual element was a giant digital timer projected onto a screen behind the panelists that ticked backwards, second by second, from two minutes to zero, making the parade of speeches a cross between speed dating and a NASA countdown.

After my own 120 seconds of counsel — during which time I (rapidly) advised the EPA to consider revisiting its own prior investigation of PCBs in the Hudson River, at least some molecules of which seeped into the water through naturally occurring fissures and hairline cracks (*seventy-nine seconds; talk faster*) in the shale bedrock beneath General Electric's factory floor, migratory pathways not previously known or even thought possible — I had plenty of time to listen to the other presentations.

Because the EPA had signaled a possible willingness to expand the scope of its study to consider cumulative impacts, the pro-drilling contingent was on the defensive. One after the other, the self-identified "landowners" — which seemed to be code for "people who believe that the federal government should not get between a man and his gas lease" — urged the EPA to "restrict inquiry" and "resist the temptation" of more deliberation.

Back in the cheap seats, I practiced sympathy for this position. What would it be like, I asked myself, to view scientific inquiry as meddlesome dithering? As someone who, in other circumstances, has argued that the time for action had arrived, I could almost understand the impatience of those who viewed fracking as a bold enterprise rather than complete lunacy.

But, soon, the repeated calls for expediency were followed by dismissive comments about water, and whatever empathy I might have felt for the opposition vanished. One man intoned rhapsodically, "Energy is Life," and then added with a smirk, "Water is a Resource." I thought that maybe I had heard it backwards, but then he repeated his assertion again, with even more sanctimony: "Energy is

Life; Water is a Resource." It felt like a Monty Python Drop-the-Cow kind of moment, but, alas, no cows fell.

And then came the untruths. The millions of gallons of fresh water used by gas wells during fracking operations are exceeded, claimed one petitioner, by the leaks in the New York City water system. They are exceeded by the water used to irrigate golf courses claimed another. Huge amounts of water are wasted doing all kinds of things.

A geologist friend and I looked at each other in wonderment, and in my head, I began to imagine a 120-second rebuttal. It would go like this: Fracking constitutes consumptive water use, which is different from what happens to water when underground pipes leak and water re-enters the aquifer, or when irrigation leads to evaporation and cloud formation. When water is entombed in deep geological strata, a mile or more below the water table, it's permanently removed from the water cycle. As in, forever. It will never again ascend into the clouds, freeze into snowflakes, melt into rivulets, cascade over rocks, turn with the tide, soak into soil, rise through roots, or pour from your tap. It will never again become blood, tears, sweat, urine, milk, sap, nectar, yolk, honey, or the juice of a fruit. It will never again float a leaf boat, swell a bud, quench a thirst, fill a swamp, spill over an edge, slosh, dribble, spray, trickle, splash, drip, or glisten. Never again fog, mist, frost, ice, dew, or rain. It's gone. To conclude: fracking turns fresh water into poison and makes the water disappear. That's something we've not done before on a large scale. And by the way, water is life. It's energy that's a resource.

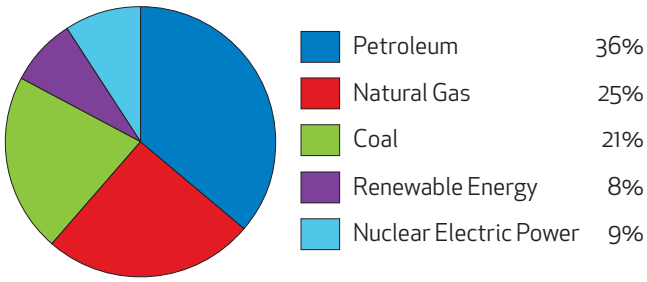
An older man rose to speak. He announced he had a special presentation. And then he let ten seconds of silence fill the theater while, before him, the monumental numbers projected on the screen blinked away.

After hours of ceaseless, rapid-fire speech, the sudden hush flowed through the overheated room like cool water. Someone giggled nervously. And then, finally, he spoke. That silence, he announced, represented the sounds of migratory birds. And tourists. And professors. And organic farmers. And thus with no words at all he reminded the audience of all the good members of our beloved community who would — if our land filled up with drill rigs, waste ponds, compressor stations, and diesel trucks — disappear, exit the cycle. As in, forever.

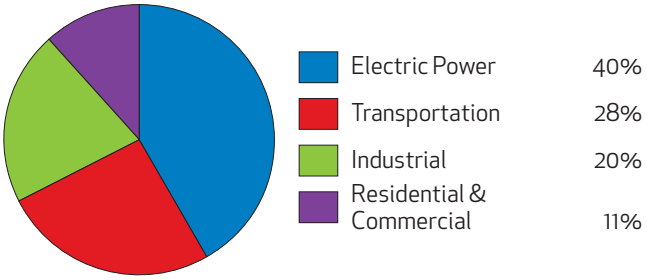
04. 03. 02. 01. Mute. And then he sat down.

An acclaimed ecologist and author, Sandra Steingraber explores the links between human rights and the environment, with a focus on chemical contamination. Sandra's most recent book is *Raising Elijah: Protecting Children in an Age of Environmental Crisis*. She lives with her family above the as-of-yet unfractured Marcellus Shale in upstate New York.

U.S. Energy Consumption by Source, 2010



U.S. Energy Consumption by Sector, 2010



Source: U.S. Energy Information Administration, *Primary Energy Consumption by Source and Sector*

WOULD THE WORLD BE BETTER OFF WITHOUT NUCLEAR POWER?

By Amory Lovins

This piece was originally published on April 8, 2011 as part of an online debate featured by The Economist. *Expert insight from Amory Lovins and others represents both sides of the challenge. The full debate is available at http://www.economist.com/debate/days/view/685*

For four decades we have known modern energy systems could threaten civilisation in two ways — climate change and nuclear proliferation — so we must reject both fates, not trade one for the other.

New nuclear build worsens both problems. It provides do-it-yourself bomb kits in civilian disguise. It reduces and retards climate protection by saving 2-10 times less carbon per dollar — and 20-40 times slower — than superior low- and no-carbon competitors. But taking economics seriously and buying those cheaper options instead can protect climate, peace and profits.

Nuclear enthusiasm pervades powerful bureaucracies from Beijing to London and Tokyo to Washington, so 65 nuclear plants were under construction worldwide at the end of 2010. Twelve had been so listed for over 20 years, 45 had no official start-up date, most were late, 50 were in four untransparent power systems (25 in China, 25 in India, Russia and South Korea), all 65 were bought by central planners, and not one was a free-market purchase fairly competed against or compared with alternatives.

In contrast, renewables rule the marketplace, providing half the world's new generating capacity in 2008-09 and 55% in America in 2009 (compared with 2% in 2004). But while wind and solar boom, nuclear and coal orders wither. Their cost and risk dissuade investors.

New American nuclear plants are 100% or more subsidised, but cannot raise private capital because they have no business case — just four daunting risks.

First, the Fukushima accident just vaporised the balance sheet of the world's fourth-largest power company. A 2007 earthquake had cost TEPCO perhaps $20 billion; this one could cost it over $100 billion. And with such an unforgiving technology, accidents anywhere are accidents everywhere.

Next, ways to save electricity are getting better and cheaper, flattening OECD and slackening global demand growth: integrative design even offers expanding not diminishing returns. "Negawatts" are China's top development priority.

Third, atrophied skills, overstretched supply chains and sheer complexity keep nuclear capital expenditure soaring. The last American nuclear binge's threefold cost overruns devastated utilities' balance sheets: only 41% of ordered plants were built and survive. In the past five years, estimated capital expenditure for new build rose three-

eightfold. No country has demonstrated a nuclear learning curve. Even France's last plant was 3.5 times more costly and nearly twice as slow as its first. France's new Finnish plant is nearing twice its planned cost and duration; its French sister station also disappoints.

Finally, innovation and mass production, not giant units, make nuclear power's renewable competitors inexorably cheaper: wind turbines by one-fifth since 2007 (and now beat new nuclear costs two-threefold), and solar by half with another 10-25% drop expected this year. No wonder "micropower" — CHP (combined heat and power) plus renewables minus big hydro — made 91% of the world's new electricity in 2008.

In 2010 all renewables excluding big hydro got $151 billion of global private investment (nuclear got none) and surpassed nuclear power's total global installed capacity. By 2014 they will exceed its output. Just one new solar power plant, buildable sooner than one new reactor, would outproduce and outcompete all 65 under-construction reactors.

But doesn't the variability of wind and solar disqualify them as unreliable? Quite the contrary.

All power plants fail. When nuclear or coal plants fail — 6-7% of the time without warning and another 4-7% predictably — 1 billion watts vanish in milliseconds, often for weeks or months. Physics makes suddenly stopped nuclear plants hard to restart: when nine plunged from 100% to 0% output in the 2003 north-east America blackout, they were idled for days and took a fortnight to restore fully.

Fortunately, utility engineers have cleverly designed the grid so all these intermittent (unpredictably failing) power stations back each other up. Variable renewables can do the same but fail more gracefully. Achieving equal or better reliability even with 80-90% variable renewables takes four steps: diversify wind and solar by location (seeing different weather) and by type (responding differently); forecast them; add renewables dispatchable at need (small hydro, geothermal, biomass/waste, solar-thermal-electric, etc); and integrate them with flexible demand and supply. Four German states' 2010 electricity was thus 43-52% wind-powered. Denmark is one-fifth wind-powered and has Europe's most reliable electricity at its lowest pre-tax prices.

Computing no longer needs mainframes; electricity no longer needs giant plants. A diverse portfolio of mass-produced generators networked in microgrids can be as resilient as the internet, so the Pentagon prefers them. Onsite and local generation even bypass the 98-99% of power failures that originate in the grid.

China is now number one in five renewable technologies and aims to be so in all. Thanks to private enterprise, China passed its 2020 wind- power target in 2010 and India has more wind power than nuclear power. China's 2006 renewables (excepting big hydro) had seven times nuclear's capacity and were growing seven times faster; by 2010 that gap had widened despite the world's most ambitious nuclear programme.

New nuclear build is uneconomic and unnecessary, so we need not debate whether it is also proliferative and dangerous. In a world of fallible and malicious people, it is actually both, but even after 60 years' immense subsidies and devoted effort, nuclear power still cannot clear the first two hurdles — competitiveness and need. End of story.

There are many perspectives on nuclear energy, even among environmentalists. In this article, physicist and environmental scientist Amory Lovins offers one perspective. Here is another from physicist Spencer Weart: **Shunning Nuclear Power Plants Will Lead to a Warmer World** http://e360.yale.edu/feature/shunning_new_nuclear_power_plants_will_lead_to_warmer_world/2510/

Amory Lovins is an American physicist, one of the world's leading authorities on energy, and has been active at the nexus of energy, resources, environment, development, and security in more than 50 countries for 35 years. Rocky Mountain Institute (RMI) is an independent, entrepreneurial non-profit think-and-do tank that drives the efficient and restorative use of resources. RMI envisions a world thriving, verdant and secure, for all, forever. For more information, see www.RMI.org.

SCRAPPING FOSSIL-FUEL SUBSIDIES WOULD GET US HALFWAY THERE ON CLIMATE CHANGE

By Brad Plumer

Here's one free-market way to tackle global warming. In 2010, the world spent $409 billion on fossil-fuel subsidies to artificially lower the price of coal, gas and oil. Eliminating those subsidies would curb fuel use and lead to half the emissions cuts necessary to avoid 2°C of warming.

That's all according to Fatih Birol, chief economist at the International Energy Agency. The Guardian's Datablog supplies the chart. By Birol's calculations, scrapping all subsidies for fossil-fuel consumption would avoid 2.56 gigatons of carbon-dioxide per year by 2035 — or about 70 percent of what the European Union currently emits. That could provide almost half of the extra cuts the world needs to stay within its carbon budget:

So what do these fuel subsidies entail? Duncan Clark offers a full country-by-country breakdown. Governments in Iran, Saudi Arabia, Egypt, Venezuela, Indonesia and elsewhere all spend money to reduce the price of gasoline at the pump, which in turn encourages higher oil use. Other nations, like Russia, offer natural-gas discounts for heating. China spends $2 billion per year to promote coal-burning. And so on.

Such subsidies are frequently touted as poverty-assistance measures, but they're not particularly effective at that task — as Birol observed, the poorest 20 percent of the population in these countries received just 8 percent of the benefits.

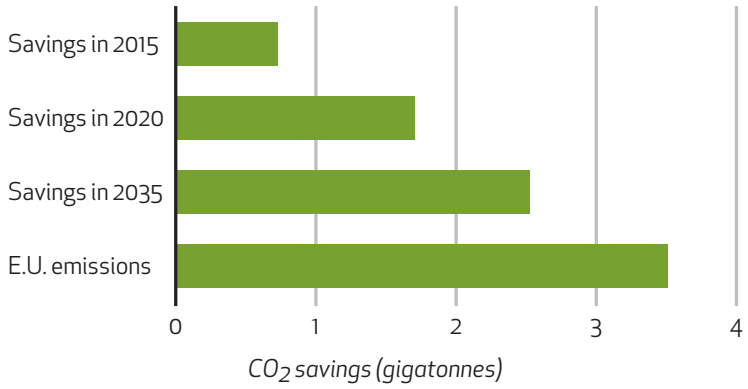
But that doesn't mean scrapping these subsidies will be easy. In recent weeks, Nigeria has been upended by strikes and ferocious mass protests over a government plan to pare back popular fuel-import subsidies. And it's all well and good to hector Saudi Arabia about its lavish gasoline subsidies — Saudi residents already have extremely high carbon footprints — but what about poorer countries like India? Can they really afford to curtail energy use?

One possible solution comes from a 2008 Harvard Kennedy School study, which suggested that developing countries could take the money saved by rolling back subsidies and devote it toward efficiency upgrades or even lump-sum payments to citizens.

Still, even if wonks find this solution elegant, the politics are often hideous, not least because there are plenty of wealthy countries, including the United States, that still directly and indirectly subsidize their own fossil-fuel production. The OECD estimates (PDF) that developed countries spend about $45 billion to $75 billion each year supporting their oil, gas and coal industries. The Obama administration tried to pare back a few oil tax breaks early in its term and found its efforts stymied by Congress. And as long as developed countries won't bother junking their own subsidies, it's hard to envision poorer countries taking the lead on this.

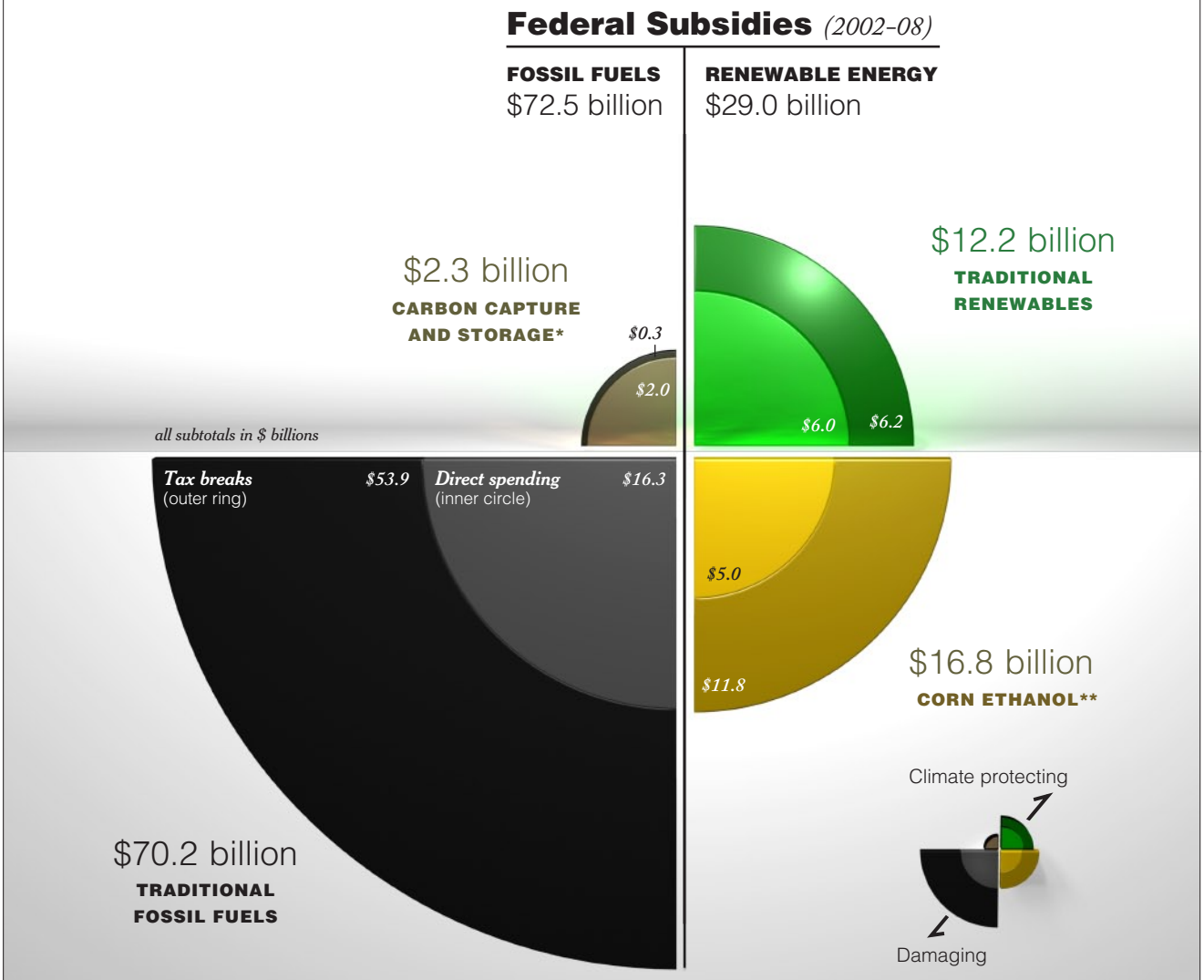
Brad Plumer is a reporter at the *Washington Post* writing about domestic policy, particularly energy and environmental issues. This article was originally featured on Ezra Klein's Wonkblog on the *Washington Post's* website on January 20, 2012.

CO_2 savings from phase-out of fossil-fuel consumption subsidies, with current EU emissions for comparison



Energy Subsidies Black, Not Green

A study released by the Environmental Law Institute, a nonpartisan research and policy organization, shows that the federal government has provided substantially larger subsidies to fossil fuels than to renewables. Subsidies to fossil fuels totaled approximately $72 billion over the seven-year study period, while subsidies for renewable fuels totaled $29 billion over the same period. The vast majority of subsidies support energy sources that emit high levels of greenhouse gases when used as fuel. Moreover, just a handful of tax breaks make up the largest portion of subsidies for fossil fuels, with the most significant of these, the Foreign Tax Credit, supporting the overseas production of oil. More than half of the subsidies for renewables are attributable to corn-based ethanol, the use of which, while decreasing American reliance on foreign oil, has generated concern about climate effects.These figures raise the question of whether scarce government funds might be better allocated to move the United States towards a low-carbon economy.



Notes: *Carbon capture and storage is a developing technology that would allow coal-burning utilities to capture and store their carbon dioxide emissions. Although this technology does not make coal a renewable fuel, if successful it would reduce greenhouse gas emissions compared to coal plants that do not use this technology. **Recognizing that the production and use of corn-based ethanol may generate significant greenhouse gas emissions, the data depict renewable subsidies both with and without ethanol subsidies.
Sources: Internal Revenue Service, U.S. Department of Energy (Energy Information Administration), Congressional Joint Committee on Taxation, Office of Management and Budget, & U.S. Department of Agriculture, via Environmental Law Institute.

Infographic by Tommy McCall

Full report text and PDF of this graphic may be found online at http://www.eli.org/pressdetail.cfm?ID=205

CLIMATE PROPOSAL PUTS PRACTICALITY AHEAD OF SACRIFICE

By John Tierney

The [January 2012] issue of the journal *Science* contains a proposal to slow global warming that is extraordinary for a couple of reasons:

1. In theory, it would help people living in poor countries now, instead of mainly benefiting their descendants.

2. In practice, it might actually work.

This proposal comes from an international team of researchers — in climate modeling, atmospheric chemistry, economics, agriculture and public health — who started off with a question that borders on heresy in some green circles: Could something be done about global warming besides forcing everyone around the world to use less fossil fuel?

Ever since the Kyoto Protocol imposed restrictions in industrial countries, the first priority of environmentalists has been to further limit the emission of carbon dioxide. Burning fewer fossil fuels is the most obvious way to counteract the greenhouse effect, and the notion has always had a wonderfully virtuous political appeal — as long as it's being done by someone else.

But as soon as people are asked to do it themselves, they follow a principle identified by Roger Pielke Jr. in his book "The Climate Fix." Dr. Pielke, a political scientist at the University of Colorado, calls it iron law of climate policy: When there's a conflict between policies promoting economic growth and policies restricting carbon dioxide, economic growth wins every time.

The law holds even in the most ecologically correct countries of Europe, as Dr. Pielke found by looking at carbon reductions from 1990 until 2010.

The Kyoto Protocol was supposed to put Europe on a new energy path, but it contained so many loopholes that the rate of "decarbonization" in Europe did not improve in the years after 1998, when the protocol was signed, or after 2002, when it was ratified. In fact, Europe's economy became more carbon-intensive in 2010, he says — a trend that seems likely to continue as nuclear power plants are shut down in Germany and replaced by coal-burning ones.

"People will make trade-offs, but the one thing that won't be traded off is keeping the lights on at reasonable cost," he says. Given the reluctance of affluent Europeans to make sacrifices, what are the odds of persuading billions of people in poorer countries to pay more for energy today in return for a cooler climate at the end of the century?

But suppose they were offered a deal with immediate benefits, like the one proposed in Science by researchers in the United States, Britain, Italy, Austria, Thailand and Kenya. The team looked at ways to slow global warming while also reducing the soot and smog that are damaging agriculture and health.

Black carbon, the technical term for the soot spewed from diesel engines and traditional cookstoves and kilns, has been blamed for a significant portion of the recent warming in the Arctic and for shrinking glaciers in the Himalayas. Snow ordinarily reflects the sun's rays, but when the white landscape is covered with soot, the darker surface absorbs heat instead.

Methane, which is released from farms, landfills, coal mines and petroleum operations, contributes to ground-level ozone associated with smog and poorer yields from crops. It's also a greenhouse gas that, pound for pound, is far more powerful than carbon dioxide at trapping the sun's heat.

After looking at hundreds of ways to control these pollutants, the researchers determined the 14 most effective measures for reducing climate change, like encouraging a switch to cleaner diesel engines and cookstoves, building more efficient kilns and coke ovens, capturing methane at landfills and oil wells, and reducing methane emissions from rice paddies by draining them more often.

If these strategies became widespread, the researchers calculate, the amount of global warming in 2050 would be reduced by about one degree Fahrenheit, roughly a third of the warming projected if nothing is done. This impact on temperatures in 2050 would be significantly larger than the projected impact of the commonly proposed measures for reducing carbon dioxide emissions.

Not incidentally, the researchers calculate, these reductions in low-level ozone and black carbon would yield lots of benefits long before 2050. Because people would be breathing cleaner air, 700,000 to 4.7 million premature

deaths would be avoided each year. Thanks to improved crop yields, farmers would produce at least 30 million more metric tons of food annually.

"The beauty of these pollution-control measures is that over five to 10 years they pay for themselves in the developing world," says Drew Shindell, the lead author of the proposal, who is a climate scientist at the NASA Goddard Institute for Space Studies and at Columbia University. "They slow global warming, but there are local benefits, too. If you make black carbon reductions in China or India, you get most of the benefits in China or India."

These ideas already have a few fans, including Ted Nordhaus, a founder of theBreakthrough Institute, which has endorsed similar measures in a report called "Climate Pragmatism." Mr. Nordhaus sees the Science paper as a model for the future.

"This is what the post-Kyoto world will look like," he says. "We'll increasingly be managing ecological problems like global warming, not solving them. We may make some headway in limiting our emissions, but if we do so it will be through innovating better energy technologies and implementing them at the national and regional level, not through top-down international limits."

These pollution-control policies aren't especially controversial — even Republicans hostile to environmentalists have supported research into black carbon — but neither have they have been especially popular. Mainstream environmental groups haven't put them on the agenda. One reason is the lack of glamour: Encouraging villagers to use diesel engine filters and drain their rice paddies is less newsworthy than negotiating a global treaty on carbon at a United Nations conference.

Another reason is the fear of distracting people from the campaign against carbon dioxide, the gas with the most long-term impact. Because it lingers in the atmosphere much longer than soot or methane, some scientists argue that limiting it must be the first step. Dr. Shindell says he agrees with the need to limit carbon dioxide and sympathizes with those who worry about losing focus.

"But I also worry that carbon dioxide will go up even if we do focus on it," he says. "We're at a complete deadlock on carbon dioxide. Dealing with the short-lived pollutants might really be a way to bridge some of the differences, both between the two sides in the United States and between the developed and the developing world."

No matter what people think about global warming, there aren't a lot of fans of dirty snow, poor crops and diseased lungs.

John Tierney is a journalist and author who has worked for the *New York Times* since 1990. Tierney writes a science column, *Findings*, for the *Times*, and often takes a contrarian view of science and society. His 1996 article "Recycling Is Garbage" broke the *New York Times Magazine's* hate mail record.

U.S. CARBON EMISSIONS DOWN 7 PERCENT IN FOUR YEARS: EVEN BIGGER DROPS COMING

By Lester R. Brown

Between 2007 and 2011, carbon emissions from coal use in the United States dropped 10 percent. During the same period, emissions from oil use dropped 11 percent. In contrast, carbon emissions from natural gas use increased by 6 percent. The net effect of these trends was that U.S. carbon emissions dropped 7 percent in four years. And this is only the beginning.

The initial fall in coal and oil use was triggered by the economic downturn, but now powerful new forces are reducing the use of both. For coal, the dominant force is the Beyond Coal campaign, an impressive national effort coordinated by the Sierra Club involving hundreds of local groups that oppose coal because of its effects on human health.

In the first phase, the campaign actively opposed the building of new coal-fired power plants. This hugely successful initiative, which led to a near de facto moratorium on new coal plants, was powered by Americans' dislike of coal. An Opinion Research Corporation poll found only 3 percent preferred coal as their electricity source — which is no surprise. Coal plant emissions are a leading cause of respiratory illnesses (such as asthma in children) and mercury contamination. Coal burning causes 13,200 American deaths each year, a loss of life that exceeds U.S. combat losses in 10 years of war in Afghanistan and Iraq.

The campaign's second phase is dedicated to closing existing coal plants. Of the U.S. total of 492 coal-fired power plants, 68 are already slated to close. With current and forthcoming U.S. Environmental Protection Agency air quality regulations on emissions of mercury, sulfur, and ozone precursors requiring costly retrofits, many more of the older, dirtier plants will be closed.

In August, the American Economic Review — the

country's most prestigious economics journal — published an article that can only be described as an epitaph for the coal industry. The authors conclude that the economic damage caused by air pollutants from coal burning exceeds the value of the electricity produced by coal-fired power plants. Coal fails the cost-benefit analysis even before the costs of climate change are tallied.

In July 2011, New York Mayor Michael Bloomberg announced a grant of $50 million to the Beyond Coal campaign. It is one thing when Michael Brune, head of the Sierra Club, says that coal has to go, but quite another when Michael Bloomberg, one of the most successful businessmen of his generation, says so.

The move to close coal plants comes at a time when electricity use for lighting will be falling fast as old-fashioned incandescent light bulbs are phased out. In compliance with the Energy Independence and Security Act of 2007, by January 2012 there will be no 100-watt incandescent light bulbs on store shelves. By January 2014, the 75-watt, 60-watt, and 40-watt incandescents will also disappear from shelves. As inefficient incandescents are replaced by compact fluorescents and LEDs, electricity use for lighting can drop by 80 percent. And much of the switch will occur within a few years.

The U.S. Department of Energy projects that residential electricity use per person will drop by 5 percent during this decade as light bulbs are replaced and as more-efficient refrigerators, water heaters, television sets, and other household appliances come to market.

Even as coal plants are closing, the use of wind, solar, and geothermally generated electricity is growing fast. Over the last four years, more than 400 wind farms — with a total generating capacity of 27,000 megawatts — have come online, enough to supply 8 million homes with electricity. (See data.) Nearly 300,000 megawatts of proposed wind projects are in the pipeline awaiting access to the grid.

Texas, long the leading oil-producing state, is now the leading generator of electricity from wind. When the transmission lines linking the rich wind resources of west Texas and the Texas panhandle to the large cities in central and eastern Texas are completed, wind electric generation in the state will jump dramatically.

In installed wind-generating capacity, Texas is followed by Iowa, California, Minnesota, and Illinois. In the share of electricity generation in the state coming from wind, Iowa leads at 20 percent.

With electricity generated by solar panels, the United States has some 22,000 megawatts of utility-scale projects in the pipeline. And this does not include residential installations.

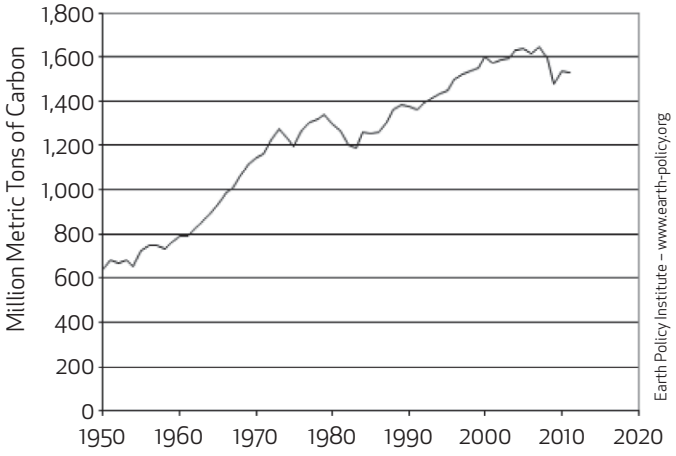
Closing coal plants also cuts oil use. With coal use falling, the near 40 percent of freight rail diesel fuel that is used to move coal from mines to power plants will also drop.

In fact, oil use has fallen fast in the United States over the last four years, thus reversing another long-term trend of rising consumption. The reasons for this include a shrinkage in the size of the national fleet, the rising fuel efficiency of new cars, and a reduction in the miles driven per vehicle.

Fleet size peaked at 250 million cars in 2008 just as the number of cars being scrapped eclipsed sales of new cars. Aside from economic conditions, car sales are down because many young people today are much less automobile-oriented than their parents.

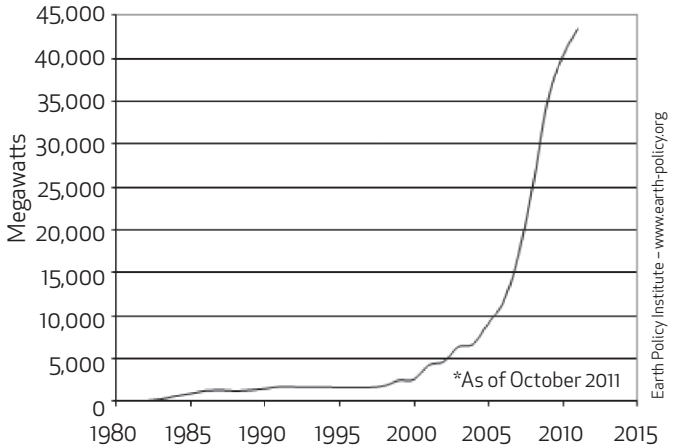
In addition, the fuel efficiency of new cars, already rising, will soon increase sharply. The most recent efficiency standards mandate that new cars sold in 2025 use only half as much fuel as those sold in 2010. Thus with each passing year, the U.S. car fleet becomes more fuel-efficient, using less gasoline.

U.S. Energy-Related Carbon Dioxide Emissions 1950-2010, with Projection for 2011



Source: EPI from EIA

Cumulative Installed Wind Power Capacity in the United States, 1980-2011*



Source: EPI from WorldWatch, GWEC, AWEA

Miles driven per car are declining because of higher gasoline prices, the continuing recession, and the shift to public transit and bicycles. Bicycles are replacing cars as cities create cycling infrastructure by building bike paths, creating dedicated bike lanes, and installing sidewalk parking racks. Many U.S. cities, including Washington, D.C., Chicago, and New York, are introducing bike-sharing programs.

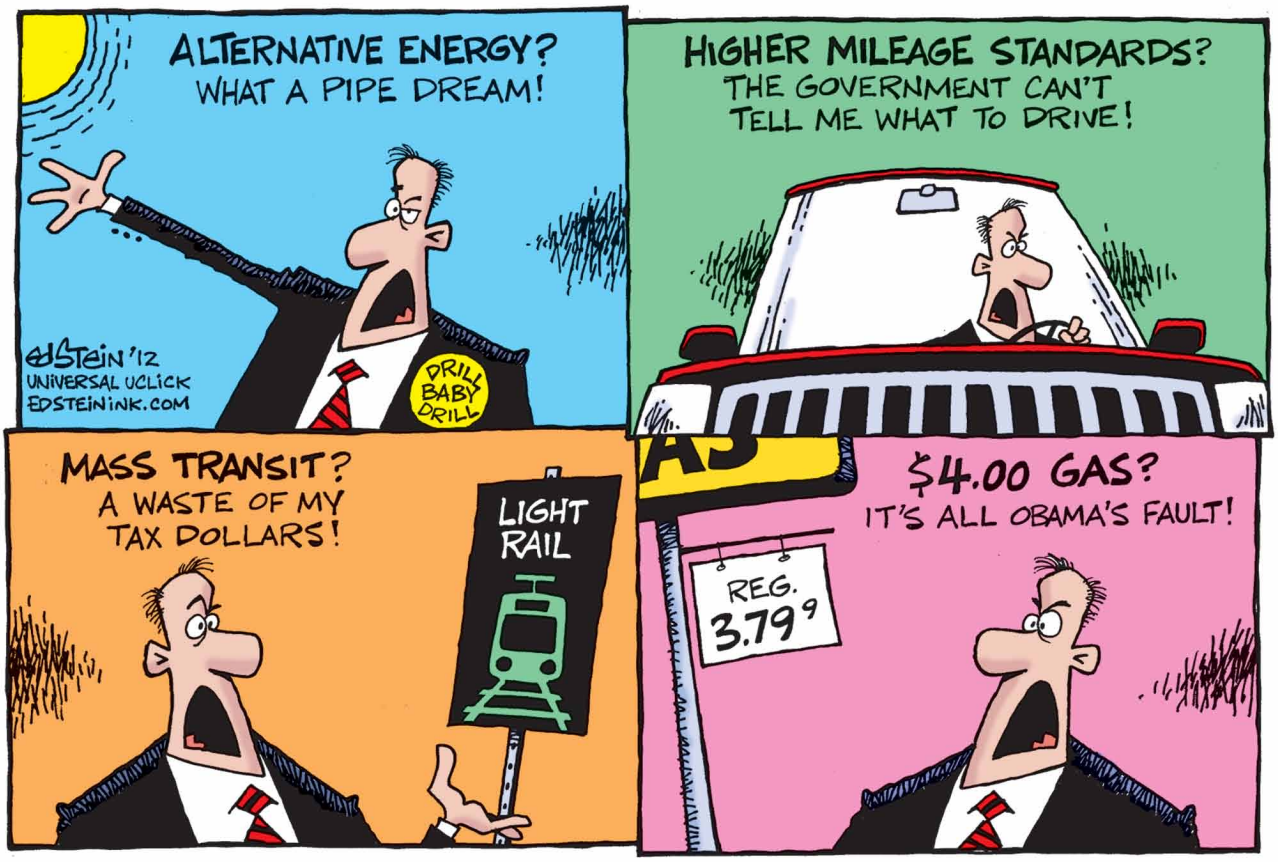
Furthermore, when people retire and no longer commute, miles driven drop by a third to a half. With so many baby boomers now retiring, this too will lower gasoline use.

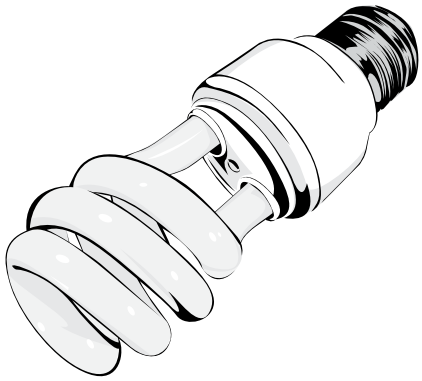
As plug-in hybrid and all-electric cars come to market, electricity will replace gasoline. An analysis by Professor Michael McElroy of Harvard indicates that running a car on wind-generated electricity could cost the equivalent of 80-cent-a-gallon gasoline.

With emissions from coal burning heading for a free fall as plants are closed, and those from oil use also falling fast — both are falling faster than emissions from natural gas are ramping up — U.S. carbon emissions are falling.

We are now looking at a situation where the 7 percent decline in carbon emissions since the 2007 peak could expand to 20 percent by 2020, and possibly even to 30 percent. If so, the United States could become a world leader in cutting carbon emissions and stabilizing climate.

Lester R. Brown is president of the Earth Policy Institute and author of *World on the Edge*. (2011)





HOW TO PLUG IN

"UNLESS someone like you cares a whole awful lot, nothing is going to get better. It's not."

— FROM *THE LORAX* BY DR. SEUSS

SESSION GOALS

- **To consider what changes need to be made in order to create a sustainable energy future.**
- **To explore ways to address energy issues in our personal lives.**
- **To commit to action around energy issues.**

SESSION BACKGROUND

Session Two offers stories of what individuals are doing to address energy issues and helps participants explore ways to address energy issues in their own lives, including increasing energy efficiency, seeking business innovations, and activism.

SUGGESTED GROUP ACTIVITY

Before the second group session, conduct a home energy audit or do a carbon footprint exercise. Share with your group the areas in which you most need improvement and the areas in which you are making good progress. In which areas can you most easily make immediate change?

FURTHER RESOURCES

Interested in finding out more on the topics presented in this session? Visit our website for further readings and resources: **www.nwei.org/powering-a-bright-future/resources**

Join our Facebook page to continue the discussion online: **www.facebook.com/northwestearthinstitute**

Circle Question

How do the readings in this session make you feel? What do they inspire you to do?

Circle questions should move quickly — each member responds briefly without questions or comments from others. Facilitator guidelines are on page 8.

SUGGESTED DISCUSSION QUESTIONS

1. **Reading about what Henry Red Cloud has done in his community can be positive and inspiring. What do you want your community to do? What are some of the barriers preventing this from happening?**
2. **Henry Red Cloud's Renewable Energy Center is planning for the future while gaining inspiration from the past. What inspiration and wisdom can you gather from your family, faith or community traditions that would help you in addressing our most pressing energy issues?**
3. **After reading Lester Brown's suggestions for achieving energy efficiency, what are you motivated to do in your own life? How could you work to make your community, workplace, school or state more energy efficient?**
4. **In which area of energy efficiency outlined by Lester Brown do you need the most work? In which area is it easiest to achieve tangible and immediate results?**
5. **Have you changed your incandescent lightbulbs to CFLs or LEDs? If so, have you noticed a savings in your energy use and electricity bill? If not, what is keeping you from making the switch?**
6. **Did you find Berners-Lee's overview of his decision-making process regarding climate change helpful? What questions or ideas did it stir?**
7. **Is Climate Change connected to your concern about energy? Why or why not?**
8. **What values do you have in common with your neighbors and colleagues, even if you differ in your political leanings? How have you had successful conversations about energy issues and climate change with those who have differing opinions?**
9. **We read about a 16-year-old who is very active in reducing carbon emissions and climate change. How do you think you can engage with others on a deeper level to mitigate climate change?**

PUTTING IT INTO PRACTICE

- Unplug laptop chargers, DVD players, coffee makers, phone chargers — anything not in use.
- Choose energy efficient appliances when making purchases.
- Plant trees in your yard. They absorb carbon dioxide, shade your house from the summer's heat, and provide living spaces and food for many creatures.
- Find out if your local government has developed or is working on a Climate Action Plan. Let your elected officials know what you would like to see happen in your community regarding energy efficiency, greenhouse gas reductions, and climate change mitigation.

DEFINITION OF TERMS

An externality is an impact created by the use or development of a product or material that is not directly reflected in its price. Externalities can be both positive and negative. Examples include:

- A person buying a bicycle to use as transportation solely for the purpose of exercise is also unintentionally reducing their CO_2 emissions (positive).
- Someone who buys a Hummer is contributing to foreign fossil fuel dependence and global climate change while only paying for the parts it took to create the car (negative).

Internalizing externalities refers to reflecting the social and environmental impacts of a product in its price, rather than that price just being the monetary sum of the material parts; like giving people greater access to bikes by lowering the price of quality bicycles, or making a Hummer more expensive to account for its impact on global warming.

Embodied energy refers to the total amount of energy input that it takes to provide a given service, product, etc. For example: the embodied energy for a conventional apple might include any pesticides or fertilizers used to grow the apple, labor or machinery used to harvest the apple, any processing the apple undergoes before it is shipped, shipping, storage, and the energy you input in retrieving the apple from the store.

SESSION 2 ACTION PLAN: HOW TO PLUG IN

After completing the readings for this week, take some time to consider actions you can take to live more intentionally and purposefully.

The "Putting It Into Practice" section and example boxes below can get you started with ideas.

For each category:

1. **Identify** current habits and behaviors you would like to change.
2. **Brainstorm** new habits. Be sure to be realistic, yet challenging.
3. **Select one** change you will make before your group meets again.

*Commit to one specific change this week, and begin to add more changes into your life as time goes on. This is an ongoing process.

Category	Identify	Brainstorm	Select One
In My Community What can you do in your community to make energy production and use more sustainable?	Our community has limited options for public transportation.	Start a petition, write a letter, or campaign for a clean energy candidate.	

Category	Identify	Brainstorm	Select One	Timeline / Completion
In My Own Life What can you do in your own life to reduce energy usage and waste and/or to support renewable energy production?				
In My Community What can you do in your community to make energy production and use more sustainable — both now and for the future?				
Your Choice In what other ways can you take action to address our most pressing energy issues?				

*To see how others have implemented some of these ideas into their daily lives, check out our blog at http://blog.nwei.org and the EcoChallenge website at www.ecochallenge.org.

PEAK OIL: A CHANCE TO CHANGE THE WORLD

By Richard Heinberg

Worcester Polytechnic Institute in Worcester, MA invited Rex Tillerson, CEO of ExxonMobil, to give the commencement speech at its 2011 graduation ceremonies on May 14. When students heard this, many were surprised and upset.The students then invited Richard Heinberg, Senior Fellow of Post Carbon Institute, to give an alternative commencement speech. This is what Richard Heinberg had to say.

ExxonMobil is inviting you to take your place in a fossil-fueled twenty-first century. But I would argue that Exxon's vision of the future is actually just a forward projection from our collective rear-view mirror. Despite its high-tech gadgetry, the oil industry is a relic of the days of the Beverly Hillbillies. The fossil-fueled sitcom of a world that we all find ourselves still trapped within may, on the surface, appear to be characterized by smiley-faced happy motoring, but at its core it is monstrous and grotesque. It is a zombie energy economy.

Of course, we all use petroleum and natural gas in countless ways and on a daily basis. These are amazing substances — they are energy-dense and chemically useful, and they yield enormous economic benefit. America started out with vast reserves of oil and gas, and these fuels helped make our nation the richest and most powerful in the world.

The End of the Cheap Oil Economy

But oil and gas are finite resources, so it was clear from the start that, as we extracted and burned them, we were in effect stealing from the future. In the early days, the quantities of fuel available seemed so enormous that depletion posed only a theoretical limit to consumption. We knew we would eventually empty the tanks of Earth's hydrocarbon reserves, but that was a problem for our great-great-grandkids to worry about.

Yet U.S. oil production has been declining since 1970, even with huge discoveries in Alaska and the Gulf of Mexico. Other countries are also seeing falling rates of discovery and extraction, and world crude oil production has been flat-lined for the past six years, even as oil prices have soared. According to the International Energy Agency, world crude oil production peaked in 2006 and will taper off from now on.

ExxonMobil says this is nothing we should worry about, as there are still vast untapped hydrocarbon reserves all over the world. That's true. But we have already harvested the low-hanging fruit of our oil and gas endowment. The resources that remain are of lower quality and are located in places that are harder to access than was the case for oil and gas in decades past. Oil and gas companies are increasingly operating in ultra-deep water, or in arctic regions, and need to use sophisticated technologies like hydrofracturing, horizontal drilling, and water or nitrogen injection. We have entered the era of extreme hydrocarbons.

This means that production costs will continue to escalate year after year. Even if we get rid of oil market speculators, the price of oil will keep ratcheting up anyway. And we know from recent economic history that soaring energy prices cause the economy to wither: when consumers have to spend much more on gasoline, they have less to spend on everything else.

But if investment costs for oil and gas exploration and extraction are increasing rapidly, the environmental costs of these fuels are ballooning just as quickly. With the industry operating at the limits of its technical know-how, mistakes can and will happen. As we saw in the Gulf of Mexico in the summer of 2010, mistakes that occur under a mile or two of ocean water can have devastating consequences for an entire ecosystem, and for people who depend on ecosystem services. The citizens of the Gulf coast are showing a brave face to the world and understandably want to believe their seafood industry is safe and recovering, but biologists who work there tell us that oil from the Deepwater Horizon

disaster is still working its way up the food chain.

Of course the biggest environmental cost from burning fossil fuels comes from our chemical alteration of the planetary atmosphere. Carbon dioxide from oil, gas, and coal combustion is changing Earth's climate and causing our oceans to acidify. The likely consequences are truly horrifying: rising seas, extreme weather, falling agricultural output, and collapsing oceanic food chains. Never mind starving polar bears — we're facing the prospect of starving people.

THE MISINFORMATION MACHINE

But wait: Is this even happening? A total of nearly half of all Americans tell pollsters they think either the planet isn't warming at all, or, if it is, it's not because of fossil fuels. After all, how can the world really be getting hotter when we're seeing record snowfalls in many places? And even if it is warming, how do we know that's not because of volcanoes, or natural climate variation, or cow farts, or because the Sun is getting hotter? Americans are understandably confused by questions like these, which they hear repeated again and again on radio and television.

Now of course, if you apply the critical thinking skills that you've learned here at WPI to an examination of the relevant data, you'll probably come to the same conclusion as has been reached by the overwhelming majority of scientists who have studied all of these questions in great depth. Indeed, the scientific community is nearly unanimous in assessing that the Earth is warming, and that the only credible explanation for this is rising levels of CO2 from the burning of fossil fuels. That kind of consensus is hard to achieve among scientists except in situations where a conclusion is overwhelmingly supported by evidence.

I'm not out to demonize ExxonMobil, but some things have to be said. That company plays a pivotal role in shaping our national conversation about climate change. A 2007 report from the Union of Concerned Scientists described how ExxonMobil adopted the tobacco industry's disinformation tactics, and funded some of the same organizations that led campaigns against tobacco regulation in the 1980s — but this time to cloud public understanding of climate change science and delay action on the issue. According to the report, between 1998 and 2005 ExxonMobil funneled almost $16 million to a network of 43 advocacy organizations that misrepresented peer-reviewed scientific findings about global warming science. Exxon raised doubts about even the most indisputable scientific evidence, attempted to portray its opposition to action as a positive quest for "sound science" rather than business self-interest, and used its access to the Bush administration to block federal policies and shape government communications on global warming. All of this is well-documented.

And it worked. Over the course of the past few years one of our nation's two main political parties has made climate change denial a litmus test for its candidates, which means that climate legislation is effectively unachievable in this country for the foreseeable future. This is a big victory for ExxonMobil. Its paltry $16 million investment will likely translate to many times that amount in unregulated profits. But it is a disaster for democracy, for the Earth, and for your generation.

But here's the thing. Everyone knows that America and the world will have to transition off of fossil fuels during this century anyway. Mr. Tillerson knows it as well as anyone. Some people evidently want to delay that transition as long as possible, but it cannot be put off indefinitely. My colleagues at Post Carbon Institute and I believe that delaying this transition is extremely dangerous for a number of reasons. Obviously, it prolongs the environmental impacts from fossil fuel production and combustion. But also, the process of building a renewable energy economy will take decades and require a tremendous amount of investment. If we don't start soon enough, society will get caught in a trap of skyrocketing fuel prices and a collapsing economy, and won't be in a position to fund needed work on alternative energy development.

In my darker moments I fear that we have already waited too long and that it is already too late. I hope I'm not right about that, and when I talk to young people like you I tend to feel that we can make this great transition, and that actions that have seemed politically impossible for the past forty years will become inevitable as circumstances change, and as a new hearts and minds comes to the table.

Even in the best case, though, the fact that we have waited so long to address our addiction to oil will still present us with tremendous challenges. But this is not a problem for ExxonMobil, at least not anytime soon. When the price of oil goes up, we feel the pain while Exxon reaps the profits. Even though Exxon's actual oil production is falling due to the depletion of its oilfields, corporate revenues are flush: Exxon made almost $11 billion in profits in just the past three months. This translates to jobs in the oil industry. But how about the renewable energy industry, which everyone agrees is the key to our future?

For the past forty years, every U.S. president, without exception, has said we must reduce our country's dependence on imported petroleum. Addiction to oil has become our nation's single greatest point of geopolitical, economic, and environmental vulnerability. Yet here we are in 2011, still driving a fleet of 200 million gasoline-guzzling cars, trucks, and SUVs. The inability of our elected officials to tackle such an obvious problem is not simply the result of ineptitude. In addition to funding climate denial, fossil fuel companies like Exxon have contributed to politicians' election campaigns in order to gain perks for their industry and to put off higher efficiency standards and environmental protections. Denying looming fuel supply

problems, discouraging a transition to renewable energy, distorting climate science — these are all understandable tactics from the standpoint of corporate self-interest. Exxon is just doing what corporations do. But once again, it is society as a whole that suffers, and the consequences will fall especially on your generation.

Mr. Tillerson may have informed you about his company's Global Climate and Energy Project at Stanford University. Exxon is now funding research into lowering the cost and increasing the efficiency of solar photovoltaic devices, increasing the efficiency of fuel cells, increasing the energy capacity of lithium-ion batteries for electric cars, designing higher-efficiency engines that produce lower emissions, making biodiesel fuel from bacteria, and improving carbon capture and storage. This is all admirable, if it is genuine and not just window-dressing.

Here's a reality check in that regard: Exxon is investing about $10 million a year in the Global Climate and Energy Project — an amount that almost exactly equals Mr. Tillerson's personal compensation in 2010. Ten million dollars also equals about three hours' worth of Exxon profits from last year. You tell me if you think that is a sensibly proportionate response to the problems of climate change and oil depletion from the world's largest energy company.

Even if Exxon's investments in a sustainable energy future were of an appropriate scale, they come late in the game. We are still in a bind. That's because there is no magic-bullet energy source out there that will enable world energy supplies to continue to grow as fossil fuels dwindle.

Renewable energy is viable and necessary, and we should be doing far more to develop it. But solar, wind, geothermal, tidal, and wave power each have limits and drawbacks that will keep them from supplying energy as cheaply and as abundantly as we would like. Our bind is that we have built our existing transport infrastructure and food systems around energy sources that are becoming more problematic with every passing year, and we have no Plan B in place. This means we will probably have less energy in the future, rather than more.

A CHANCE TO CHANGE THE WORLD

Again, I am addressing my words especially to you students. This will be the defining reality of your lives. Whatever field you go into — business, finance, engineering, transportation, agriculture, education, or entertainment — your experience will be shaped by the energy transition that is now under way. The better you understand this, the more effectively you will be able to contribute to society and make your way in the world.

We are at one of history's great turning points. During your lifetime you will see world changes more significant in scope than human beings have ever witnessed before. You will have the opportunity to participate in the redesign of the basic systems that support our society — our energy system, food system, transport system, and financial system.

I say this with some confidence, because our existing energy, food, transport, and financial systems can't be maintained under the circumstances that are developing — circumstances of fossil fuel depletion and an unstable climate. As a result, what you choose to do in life could have far greater implications than you may currently realize.

Over the course of your lifetime society will need to solve some basic problems:

- How to grow food sustainably without fossil fuel inputs and without eroding topsoil or drawing down increasingly scarce supplies of fresh water;
- How to support 7 billion people without depleting natural resources — including forests and fish, as well as finite stocks of minerals and metals; and
- How to reorganize our financial system so that it can continue to perform its essential functions — reinvesting savings into socially beneficial projects — in the context of an economy that is stable or maybe even shrinking due to declining energy supplies, rather than continually growing.

Each of these core problems will take time, intelligence, and courage to solve. This is a challenge suitable for heroes and heroines, one that's big enough to keep even the greatest generation in history fully occupied. If every crisis is an opportunity, then this is the biggest opportunity humanity has ever seen.

Making the best of the circumstances that life sends

our way is perhaps the most important attitude and skill that we can hope to develop. The circumstance that life is currently serving up is one of fundamentally changed economic conditions. As this decade and this century wear on, we Americans will have fewer material goods and we will be less mobile. In a few years we will look back on late 20th century America as time and place of advertising-stoked consumption that was completely out of proportion to what Nature can sustainably provide. I suspect we will think of those times — with a combination of longing and regret — as a lost golden age of abundance, but also a time of foolishness and greed that put the entire world at risk.

Making the best of our new circumstances will mean finding happiness in designing higher-quality products that can be re-used, repaired, and recycled almost endlessly; and finding fulfillment in human relationships and cultural activities rather than mindless shopping. Fortunately, we know from recent cross-cultural psychological studies that there is little correlation between levels of consumption and happiness. That tells us that life can in fact be better without fossil fuels.

So whether we view these as hard times or as times of great possibility is really a matter of perspective. I would emphasize the latter. This is a time of unprecedented opportunity for service to one's community. It's a time when it will be possible to truly change the world, because the world has to change anyway. It is a time when you can make a difference by helping to shape this needed and inevitable change.

As I travel, I meet young people in every part of this country who are taking up the challenge of building a post-petroleum future: a 25-year-old farmer in New Jersey who plows with horses and uses no chemicals; the operator of a biodiesel co-op in Northampton; a solar installer in Oakland, California. The energy transition will require new thinking in every field you can imagine, from fine arts to banking. Companies everywhere are hiring sustainability officers to help guide them through the challenges and opportunities. At the same time, many young people are joining energy and climate activist organizations like 350.org and Transition Initiatives.

So here is my message to you in a nutshell: Fossil fuels made it possible to build the world you have inhabited during your childhood and throughout your years in the education system. Now it's up to you to imagine and build the world after fossil fuels. This is the challenge and opportunity of your lifetimes. I wish you good cheer and good luck as you make the most of it.

Richard Heinberg is a senior fellow at the Post Carbon Institute and the author of *The Party's Over: Oil, War, and the Fate of Industrial Societies, Peak Everything: Waking Up to the Century of Declines,* and *The End of Growth: Adapting to Our New Economic Reality.*

HENRY RED CLOUD: SOLAR WARRIOR FOR NATIVE AMERICA

By Talli Nauman

Henry Red Cloud's address is 1001 Solar Warrior Road on the Pine Ridge Indian Reservation in South Dakota. But the road sign hasn't arrived. A windmill towering over the cottonwoods in the draw of White Clay Creek marks the location of Red Cloud Renewable Energy Center and his "Solar Warrior Community."

It consists of a mud-and-straw-bale roundhouse for trainings, a whimsically painted Quonset hut factory for assembling solar air heaters, an array of solar panels from Germany, a horse trailer that doubles as a paper recycling center for making insulation, a vegetable garden, and a new concrete foundation for what will become a 20-person dormitory.

Here Red Cloud directs the work of Lakota Solar Enterprises, his American Indian-owned and operated business dedicated to providing renewable energy to some of the poorest communities in the United States.

The business has been part of a journey home for the 52-year-old Oglala Lakota man. He left the reservation to join the civil rights movement in the 1970s, then found himself working construction, walking high steel in cities around the country.

But when he returned home, he faced the reality of few jobs and little housing. He crafted teepees and took volunteer training from Trees, Water & People, which later became his partner organization.

One night, trying to sleep in the back seat of his car, Red Cloud had the vision for Lakota Solar: training people right on the reservation to build and install solar heaters so they could study at home and support the extended family, or tiospaye. Later, he added a buffalo ranching cooperative to the enterprise.

"The house, the buffalo, renewable energy: I'm not into it to become a millionaire," Red Cloud says. "I'm just here passing it on to the next generation like the grandfathers

did for us. That way surely their prophecy is going to be realized."

Red Cloud's 16-month-old granddaughter is the seventh generation descended from Makhpiya Luta, or Chief Red Cloud, who negotiated the 1868 Fort Laramie Treaty, which left 60 million acres of buffalo hunting grounds to the Great Sioux Nation — until Congress later whittled it into smaller reservation parcels.

"Our ancestors made a treaty with the U.S. government," Red Cloud recounts. But they also made "a pact with the Creator for seven generations" — hearkening to a well-known prophecy that they would suffer if they did not provide for their descendants' future prosperity.

Red Cloud was raised by his grandparents. "You can get an education and you can live a comfortable life," he remembers his grandfather saying, "but if you want to have a really good life, create some work for other people."

To date, the Red Cloud Center has trained 84 people, most of whom have secured jobs based on the experience — a striking accomplishment given the staggering unemployment across Indian country.

Lakota Solar Enterprises has built and installed more than 1,200 small-scale individual solar heating systems. The heaters save low-income homeowners up to 30 percent on utility bills that, over the course of a freezing Northern Plains winter, can add up to more than $1,000. The systems are Red Cloud's own innovation: For two years, he fiddled with a 1970s design to come up with the $2,500 unit his business produces today. "We're using 21st century material and tweaking it Lakota-style," he says.

Recently, Red Cloud has engaged 24 Northern Plains tribes as partners. The tribes have been spending millions of dollars of federal funding to assist tribal members with energy costs, such as propane. Now they can use some of the money for energy efficiency and to send tribal members to Red Cloud's renewable energy courses.

Red Cloud also has contracts to install wind turbines and solar arrays atop public health clinics on the Pine Ridge and Rosebud Indian Reservations. He hopes the projects will help topple what he considers to be a wall of skepticism about green building techniques — the legacy of failed development projects on the reservations.

"We are just getting back to the memory of the old way and becoming sustainable again," Red Cloud says. "We have always had our Sun Dance ceremonies. We're warriors doing our warriors' deed in the 21st century for the seventh generation."

Talli Nauman wrote this article for *The YES! Breakthrough 15,* the Winter 2012 issue of *YES! Magazine*. Talli is co-founder and co-director of the Aguascalientes, Mexico-based bilingual independent media project *Periodismo para Elevar la Conciencia Ecológica, PECE (Journalism to Raise Environmental Awareness),* initiated with a MacArthur grant in 1994.

EXCERPTS FROM "ENERGY EFFICIENCY"

By Lester Brown

Advancing technologies offer the world a greater potential for cutting energy use today than at any time in history. For example, during much of the last century nearly all the household light bulbs on the market were inefficient incandescents. But today people can also buy compact fluorescent lamps (CFLs) that use only one fourth as much electricity. And the light-emitting diodes (LEDs) now coming to market use even less.[1]

A similar situation exists with cars. During the century since the automobile appeared, an internal combustion engine was the only option. Now we can buy plug-in hybrids and all-electric cars that run largely or entirely on electricity. And since an electric motor is over three times as efficient as an internal combustion engine, there is an unprecedented potential for reducing energy use in the transport sector.[2]

Beyond energy-saving technologies, vast amounts of energy can be saved by restructuring key sectors of the economy. Designing cities for people, not for cars, is a great place to begin. And if we can move beyond the throwaway society, reusing and recycling almost everything, imagine how much material and energy we can save.

LIGHTBULBS

One of the quickest ways to cut carbon emissions and save money is simply to change light bulbs. Replacing

inefficient incandescent bulbs with CFLs can reduce the electricity used for lighting by three fourths. And since they last up to 10 times as long, each standard CFL will cut electricity bills by roughly $40 over its lifetime.[3]

The world has reached a tipping point in shifting to compact fluorescents, as many countries phase out incandescents. But even before the transition is complete, the shift to LEDs is under way. Now the world's most advanced lighting technology, the LED uses even less energy than a CFL and up to 85 percent less than an incandescent. And LEDs offer another strong economic advantage — longevity. An LED installed when a child is born is likely to still be working when the youngster graduates from college.[4]

With costs falling fast, LEDs are quickly taking over several niche markets, such as traffic lights. In the United States, almost 70 percent of traffic lights have been converted to LEDs, while the figure is still less than 20 percent in Europe. New York City has changed all its traffic lights to LEDs, cutting the annual bill for power and maintenance by $6 million.[5]

For the far more numerous street lights, the potential savings are even greater. In 2009, Los Angeles Mayor Antonio Villaraigosa said the city would replace its 140,000 street lights with LEDs, saving taxpayers $48 million over seven years. With replacement well along, the electricity bill for street lights was down 55 percent as of mid-2010.[6]

Energy can also be saved by using motion sensors that turn lights off in unoccupied spaces. Automatic dimmers can reduce the intensity of interior lighting when sunlight is bright. In fact, LEDs combined with these "smart" lighting technologies can cut electricity bills by 90 percent compared with incandescents.[8]

All told, shifting to CFLs in homes, to the most advanced linear fluorescents in office buildings, commercial outlets, and factories, and to LEDs for traffic lights would cut the world share of electricity used for lighting from 19 to 7 percent. This would save enough electricity to close 705 of the world's 2,800 coal-fired plants. If the world turns heavily to LEDs for lighting by 2020, as now seems likely, the savings would be even greater.[9]

BUILDINGS

Although appliances account for a significant share of electricity use in buildings, heating and cooling require more energy in total. But buildings often get short shrift in efficiency planning, even though the sector is the leading source of carbon emissions, eclipsing transportation.

Because buildings last for 50–100 years or longer, it is often assumed that cutting carbon emissions in this sector is a long-term process. But that is not necessarily the case. An energy retrofit of an older inefficient building can cut energy bills by 20–50 percent or more. The next step, shifting entirely to renewable sources of electricity to heat, cool, and light the building, completes the job. Presto! A zero-carbon building.[15]

In April 2009, the owners of New York's Empire State Building announced plans to retrofit the iconic 80-year- old 102-story building, reducing its energy use by nearly 40 percent. The resulting annual energy savings of $4.4 million is expected to recover the retrofitting costs in three years.[18]

TRANSPORTATION

Within the transportation sector itself, there are numerous opportunities for energy savings. The first step in increasing efficiency and cutting carbon emissions is to simultaneously restructure and electrify the transport system to facilitate the shift from fossil fuels to renewable electricity. Restructuring involves strengthening urban public transportation and designing communities to reduce the need for cars. For traveling between cities, developing a high-speed intercity rail system, similar to those in Japan, Western Europe, and China, is the key.

Urban transport systems based on a combination of subways, light rail, bus lines, bicycle pathways, and pedestrian walkways offer the best of all possible worlds in providing mobility, low-cost transportation, and a healthy urban environment. And since rail systems are geographically fixed, the nodes on such a system become the obvious places to concentrate high-rise office and apartment buildings as well as shops.

Any serious global effort to cut automotive fuel use begins with the United States, which consumes more gasoline than the next 20 countries combined, including Japan, China, Russia, Germany, and Brazil. The United States — with 248 million passenger vehicles out of the global 965 million — not only has by far the largest fleet of cars but is near the top in miles driven per car and near the bottom in vehicle fuel efficiency.[28]

The car promised mobility, and in a largely rural society it delivered. But the growth in urban car numbers at some point provides not mobility, but immobility. The Texas Transportation Institute reports that U.S. congestion costs,

including fuel wasted and time lost, climbed from $17 billion in 1982 to $87 billion in 2007.[29]

Many American communities lack sidewalks and bike lanes, making it difficult for pedestrians and cyclists to get around safely, particularly where streets are heavily traveled. Fortunately, the country that has lagged far behind Europe in developing diversified urban transport systems is being swept by a "complete streets" movement, an effort to ensure that streets are friendly to pedestrians and bicycles as well as to cars.[30]

America's century-old love affair with the automobile may be coming to an end. The U.S. fleet has apparently peaked. In 2009, the 12.4 million cars scrapped exceeded the 10.6 million new cars sold, shrinking the fleet by nearly 1 percent. While this has been widely associated with the recession, it was in fact caused by several converging forces, including market saturation, ongoing urbanization, economic uncertainty, oil insecurity, rising gasoline prices, frustration with traffic congestion, and mounting concerns about climate change.[32]

Perhaps the leading social trend affecting the future of the automobile is the declining interest in cars among young people. For past generations, growing up in a country that was still heavily rural, getting a driver's license and a car or a pickup was a rite of passage. In contrast, now that the United States is 82 percent urban, more young Americans are growing up in families without cars. They socialize on the Internet and on smartphones, not in cars. Many do not even bother to get a driver's license. Because of these converging trends, I believe that the U.S. fleet could shrink 10 percent by 2020. Japan's fleet, second in size to the U.S. fleet, is also shrinking.[33]

Beyond shrinking the fleet, the key to reducing U.S. gasoline use in the near term is to raise fuel efficiency standards. The 40-percent increase in the fuel efficiency of new cars by 2016 announced by the Obama administration in May 2009 will reduce both carbon emissions and dependence on oil. A crash program to shift the U.S. fleet to plug-in hybrids and all-electric cars could make an even greater contribution. And shifting public funds from highway construction to public transit and intercity rail would further reduce the number of cars needed, bringing the United States closer to the Plan B goal of cutting carbon emissions 80 percent by 2020.[34]

Shifting to plug-in electric hybrids and all-electric cars does not require a costly new infrastructure, since the network of gasoline service stations and the electricity grid are already in place. A 2006 study by the U.S. Pacific Northwest National Laboratory estimated that over 70 percent of the electricity needs of a national fleet of plug- in cars could be satisfied with the existing electricity supply, since the recharging would take place largely at night when there is an excess of generating capacity. What will be needed in addition to home hookups are readily accessible electrical outlets in parking garages, parking lots, and street-side parking meters to facilitate recharging.[36]

Few methods of reducing carbon emissions are as effective as substituting a bicycle for a car on short trips. A bicycle is a marvel of engineering efficiency, one where an investment in 22 pounds of metal and rubber boosts personal mobility by a factor of three. On my bike I estimate that I get easily 7 miles per potato. An automobile, which typically requires at least a ton of material to transport one person, is extraordinarily inefficient by comparison.

The bicycle has many attractions as a form of personal transportation. It is carbon-free, alleviates congestion, lowers air pollution, reduces obesity, and is priced within the reach of billions of people who cannot afford a car. Bicycles increase mobility while reducing congestion and the area of land paved over. As bicycles replace cars, cities can convert parking lots into parks or urban gardens.

The key to realizing the bicycle's potential is to create a bike-friendly transport system. This means providing both bicycle trails and designated street lanes for bicycles and then linking them with public transit options. Among the industrial-country leaders in designing bicycle-friendly transport systems are the Netherlands, where 25 percent of all trips are by bike, Denmark with 18 per cent, and Germany, 10 percent. For the United States, the equivalent figure is 1 percent.[38]

While the future of transportation in cities lies with a mix of light rail, buses, bicycles, cars, and walking, the future of intercity travel belongs to high-speed trains. Japan's bullet trains, operating at up to 190 miles per hour, carry nearly 400,000 passengers a day. On some heavily used intercity lines, trains depart every three minutes.[39]

Over the last 46 years, Japan's high-speed trains have carried billions of passengers in great comfort without a fatal crash. Late arrivals average 6 seconds. If we were selecting seven wonders of the modern world, Japan's high-speed rail system surely would be among them.[40]

High-speed intercity rail links are changing travel patterns by reducing long drives and short flights, each of which is carbon-intensive. When the Brussels-to-Paris link opened, the share of people traveling between the two cities by train rose from 24 to 50 percent. The car share dropped from 61 to 43 percent, and plane travel virtually disappeared.[42]

Until recently, there was a huge gap in high-speed rail between Japan and Europe, on the one hand, and the rest of the world on the other. That is changing as China moves to the fore with both the world's fastest trains and the most ambitious high-speed rail construction program of any country. For various reasons, including land scarcity and oil dependency, China is shifting the emphasis from building American-style expressways to building an intercity network of high-speed trains linked directly to urban subway systems, some 60 of which are under construction. The goal is to reduce the need for cars and planes for medium and longer distance travel. When a 300-mile-long line opened in 2010 between Zhengzhou and Xi'an, the low-cost, two-hour train ride was so popular that all flights between the two cities were discontinued.[44]

It is time for the United States to shift investment from roads and highways to railways to build a twenty-first century transport system. In 1956, President Eisenhower launched the interstate highway system, justifying it on national security grounds. Today, both climate change and oil insecurity argue for the construction of a national high-speed rail system.[47]

RECYCLING

Beyond reducing materials use, the energy savings from recycling are huge. Making steel from recycled scrap takes only 26 percent as much energy as that from iron ore. For aluminum, the figure is just 4 percent. Recycled plastic uses only 20 percent as much energy. Recycled paper uses 64 percent as much — and with far fewer chemicals during processing. If the world recycling rates of these basic materials were raised to those already attained in the most efficient economies, world carbon emissions would drop precipitously.[53]

In the United States, only 33 percent of garbage is recycled. Some 13 percent is burned and 54 percent goes to landfills, indicating a huge potential for reducing materials use, energy use, and pollution. Among the larger U.S. cities, recycling rates vary from 25 percent in New York to 45 percent in Chicago, 65 percent in Los Angeles, and 77 percent in San Francisco, the highest of all.[54]

One way to encourage recycling is simply to adopt a

Since Thomas Edison invented the incandescent lightbulb, technological advances have increased bulb efficiency by more than 70 times. This efficiency is measured in the amount of light (lumens) per watt of electricity.

Candle	.3 Lumens/Watt
Edison's incandescent bulb	1.4 Lumens/Watt
100W modern incandescent	15-20 Lumens/Watt
2009 light-emitting diode (LED)	20-50 Lumens/Watt
Compact fluorescent (CFL)	60+ Lumens/Watt
2010 LED	100+ Lumens/Watt

landfill tax. For example, when the small town of Lyme, New Hampshire, adopted a pay-as-you-throw (PAYT) program that encourages municipalities to charge residents for each bag of garbage, it dramatically reduced the flow of materials to landfills, raising the share of garbage recycled from 13 to 52 percent in only one year, simultaneously reducing the town's landfill fees, and generating a cash flow from the sale of recycled material. Nationwide, more than 7,000 U.S. communities now have PAYT programs.[55]

In addition to measures that encourage recycling, there are those that encourage or mandate the reuse of products such as refillable beverage containers. Finland, for example, has banned the use of one-way soft drink containers. A refillable glass bottle used over and over requires only 10 percent as much energy per use as recycling an aluminum can. Banning nonrefillables is a quintuple win option — cutting material use, carbon emissions, air pollution, water pollution, and landfill costs simultaneously.[56]

BOTTLED WATER

Bottled water is even more wasteful. In a world trying to stabilize climate, it is difficult to justify bottling water (often tap water to begin with), hauling it long distances, and then selling it for 1,000 times the price of water from the kitchen faucet. Although clever marketing has convinced many consumers that bottled water is safer and healthier than tap water, a detailed study by WWF found that in the United States and Europe there are more standards regulating the quality of tap water than there are for bottled water. In developing countries where water is unsafe, it is far cheaper to boil or filter water than to buy it in bottles.[57]

Manufacturing the nearly 28 billion plastic bottles used each year to package water in the United States alone requires the equivalent of 17 million barrels of oil. This — combined with the energy used to refrigerate and haul the bottled water in trucks, sometimes over hundreds of miles — means the U.S. bottled water industry consumes roughly 50 million barrels of oil per year, equal to 13 percent of U.S. oil imports from Saudi Arabia.[58]

The opportunities to save energy are everywhere, permeating every corner of the economy, every facet of our lives, and every country. Exploiting this abundance of wasted energy will allow the world to actually reduce total energy use over the next decade. These potentially massive efficiency gains, combined with the worldwide shift to renewable energy, will move the world ever closer to the Plan B energy economy.

Lester Brown is the founder of the Worldwatch Institute and founder and president of the Earth Policy Institute. He is the author or co-author of over 50 books on global environmental issues. This excerpt is from his 2011 book *World on the Edge: How to Prevent Environmental and Economic Collapse*. Footnote data can be found at http://www.earth-policy.org/books/wote

LOW-CARBON FOOD TIPS

By Mike Berners-Lee

The following is a quick summary of the various steps you can take to reduce the carbon footprint of your diet — and the type of savings you can expect.

Eat what you buy. Ask people how much they would like before you serve them. Eat the skins. Clean the plates, pick the carcass. Save the leftovers. Check what needs to be eaten when you plan your menus. Keep vegetables in the fridge if you can. Rotate the contents of your cupboards so that old stuff is at the front. Eradicating waste is worth a 25 percent savings [of the carbon footprint of your food] for the average shopper.

Reduce meat and dairy. I'm not saying go vegan any more that I'd say never drive. But there is no dodging the fact that meat and dairy are key areas. By reducing our consumption of these food types, many of us will live a bit longer and save money as well as reducing our emissions. The vegetarians and vegans I know don't consider it a hardship. Sensible reductions in meat and dairy without needing to go vegetarian are probably worth another 25 percent savings [in the carbon footprint of your food] on a typical diet.

Go seasonal, avoiding hothouses and air freight. Local, seasonal produce is best of all, but shipping is fine. As a guide, if something has a short shelf life and isn't in season where you live, it will probably have had to go in a hothouse or on a plane. In the U.K., Canada, and more northern parts of the U.S., in January, examples are lettuce, asparagus, tomatoes, strawberries, and most cut flowers. Apples, oranges, and bananas, by contrast, almost always go on boats. Adopting this tip religiously can probably deliver a 10 percent savings on a typical diet.

For more specific information, try the following:

- The Eat Well Guide to seasonal food in different U.S. states and Canadian provinces: www.eatwellguide.org/i.php:id=Seasonalfoodguides
- Epicurious's interactive seasonal recipe map of the U.S.: www.epicurious.com/articlesguides/seasonalcooking/farmtotable/seasonalingredientmap
- Food Down the Road's simple chart showing Canada's seasonal foods by month: www.fooddowntheroad.ca/online/seasonalfoodchart.php

Avoid low-yield varieties. Cherry tomatoes and baby corn are classic examples. Estimated savings: 3 percent.

Avoid excessive packaging. Some packaging serves a valid purpose in keeping food fresh. But a metal dish inside plastic trays inside a plastic bag within a cardboard box is probably excessive. Worth around 3 to 5 percent.

Recycle your packaging. Worth 2 to 3 percent.

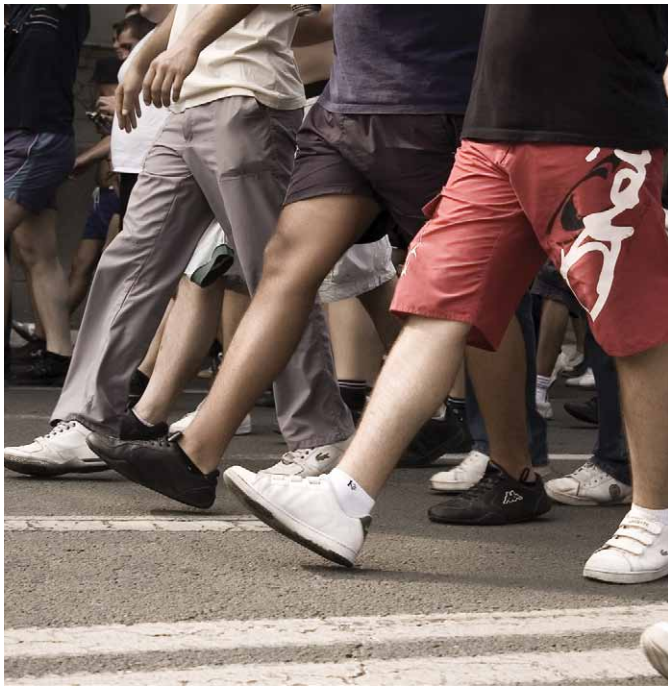
Help the store reduce waste. Always take from the front of the shelf so that the stock can be rotated. Handle food with care. Buy the reduced-price items when you can, but don't hang around waiting for them to be reduced. Worth perhaps a 1 percent savings.

Buy misshapen fruit and vegetables. Stimulate demand for the huge quantities of produce that get thrown away just because of their shape. The [carbon] savings are hard to quantify, but perhaps 1 percent.

Lower-carbon cooking. Use a pan lid whenever you can. Remember that water boils at the same temperature however much heat you apply, so for cooking food, a gentle boil is just as fast as a furious one. Use a microwave when appropriate. Perhaps a 5 percent savings.

Incredible! The [carbon footprint] savings here add up to about 75 percent. Sadly the math doesn't work out quite like that because some of these points overlap. If you do them all, they work out to more like a 60 percent savings — still a remarkable amount.

This information is excerpted from Mike Berners-Lee's 2011 book, *How Bad Are Bananas: The Carbon Footprint of Everything.*



WHY 16 YEAR-OLD ALEC LOORZ IS SUING THE GOVERNMENT

By Alec Loorz

Youth climate activists in all 50 states and the District of Columbia are suing the government in order to create an "atmospheric trust," arguing that public trust law should protect the atmosphere for people and future generations. You can read more about the lawsuit on the iMatter March website. Alec Loorz is the 16 year-old founder of Kids vs. Global Warming and now organizer of the iMatter March.

I am 16 years old. This morning I filed a lawsuit against the United States of America, for allowing money to be more powerful than the survival of my generation, and for making decisions that threaten our right to a safe and healthy planet.

Our parents' and grandparents' generations have created

TRANSPORTATION: A GAS GUZZLER

Transportation accounts for about 28% of the total energy consumed in the U.S. each year. Have you considered how much energy your transportation habits could be consuming?
Transportation accounts for more than 60% of all oil used each year.
As much as 60% of transportation energy consumption is derived from passenger transportation.
Approximately 12% of the fuel used by an automobile actually provides momentum.
A bus with 50 passengers uses about one-tenth the energy per passenger-mile as an average automobile.
Each 1% shift of mileage from automobile to non-motorized options has the potential to reduce energy consumption and pollution emissions by 2-4%.

Statistics from: *Energy Conservation and Emission Reduction Strategies, TDM Encyclopedia*

a problem. They've developed a society that depends on burning fossil fuels, like coal and oil, to survive. They never realized that there were any huge consequences to running our lives with fossil fuels. But now, we do. Our addiction to fossil fuels is messing up the perfect balance of nature and threatening the survival of my generation. If we continue to hide in denial and avoid taking action, I and my generation will be forced to grow up in a world where hurricanes as big as Katrina are normal, people die every year because of heat waves, droughts, and floods, and entire species of animals we've come to know disappear right before our eyes.

This is not the future I want. And I know that we still have a chance to turn this picture around. But, it's going to take more than changing lightbulbs and buying hybrid cars. I believe it will take nothing less than a revolution... a revolution in our entire culture and way of thinking, so that we value nature and the future of my generation with every action we take.

And I believe this revolution needs to be led by youth. It's our future we're fighting for, and we are some of the most creative, dedicated, and passionate people on the planet. We have the moral authority to look into our parents' and leaders' eyes and ask them, "Do I matter to you?"

Also, as youth, we are the last group of people in the United States who don't have any official political rights. We can't vote, and we certainly can't compete with rich corporate lobbyists, so we are forced to simply trust our government to make good decisions on our behalf.

However, it's become clear that our government has failed us, by not protecting the resources on this planet we need to survive. Even though scientists overwhelmingly agree that carbon emissions are totally messing up the balance of our atmosphere, our leaders continue to turn their backs on this crisis.

The time has come for the youngest generation to hold our leaders accountable for their actions.

Today, I and other fellow young people are suing the government, for handing over our future to unjust fossil fuel industries, and ignoring the right of our children to inherit the planet that has sustained all of civilization. I will join with youth and attorneys in every state to demand that our leaders live and govern as if our future matters.

The government has a legal responsibility to protect the future for our children. So we are demanding that they recognize the atmosphere as a commons that needs to be preserved, and commit to a plan to reduce emissions to a safe level.

The plaintiffs and petitioners on all the cases are young people. We are standing up for our future.

But we will not only stand up in the courts. We will stand up in the streets as well.

Starting this Mothers' Day weekend, the youngest generation will rise up and march in our communities. We will unite together with a powerful voice to call for action on climate change, and demand that our society lives as if our future matters.

We will let the world know that climate change is not about money, it's not about power, it's not about convenience. It's about our future. It's about the survival of this and every generation to come.

The iMatter March is a series of more than 100 marches in states all across the country, and 25 countries worldwide, including Columbia, Gambia, Germany, Thailand, India, and Nepal (on Mount Everest). There's even one being planned by the son of an oil executive in Kuwait.

And it's about more than just these events. This is a movement. A mass movement of young people standing up with a unified voice to tell the ruling generation that we will no longer just sit idly by as they make decisions that threaten our future. We matter. Our future matters.

Thomas Jefferson once said, "Every generation needs a new revolution." Well this is ours. The time has now come for the youngest generation to make a stand for our future.

This is our revolution. This is our time.

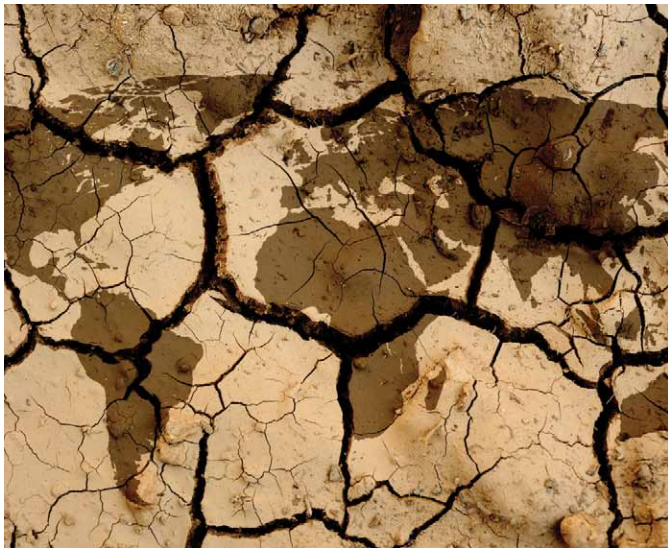
Alec Loorz is the founder of the iMatter campaign and of Kids vs Global Warming. A climate change activist since he was 12 years old, he has spoken to nearly 200,000 people in over 200 presentations, keynotes, and panels. Representing his generation, he advocates for and inspires youth to lead the way to a sustainable and just world. www.iMatterMarch.org.

ENERGY AND CLIMATE CHANGE: FINDING COMMON GROUND

Having conversations about climate change and energy uncertainty can sometimes be difficult, contentious and even infuriating. It's hard to know what and whom to believe, where to get reliable data, and how to respectfully engage those who might have very different opinions than you. However, dialogue on climate change and energy is important in finding common ground and creating a bright future. For an exploration of how to talk with others about these important issues, visit our website at www.nwei.org/powering-a-bright-future/resources, and take a look at these helpful resources:

Finding Common Ground with Climate Change Contrarians: https://www2.ucar.edu/atmosnews/opinion/finding-common-ground-climate-change-contrarians

How to Find Common Ground in the Bitter Climate Debate: http://e360.yale.edu/feature/how_to_find_common_ground_in_the_bitter_climate_debate/2438/



IS CLIMATE CHANGE A BIG DEAL AND CAUSED BY HUMANS?

By Mike Berners-Lee

Is climate change a big deal and caused by humans?

At the end of the day we all have to make up our own minds. I can't go over the scientific arguments in detail here, and even if I did I'd just be one more voice for you to sift through. But I will briefly go through how I came to make up my own mind.

None of us really knows for sure what climate change is going to mean for us in the coming decades. The science is hideously complex and uncertain. The media still report a full spectrum of arguments. It's a confusing picture for the lay-person. What basis can we have for knowing whether a news article, a TV program, or a book is credible?

A key question in this context is *how can we work out whom to trust?* I meet plenty of people who have understandably given up trusting anyone over climate change. But it is possible to do a lot better than that. This is how I make up my own mind about a report or piece of research:

1. I look at the argument itself and see if the logic makes sense at face value.
2. I look at the competence of the source.
3. I look at the resources and information that it had at its disposal.
4. Critically, I try to understand the motivations — political, financial, and psychological. How strong was the dedication to truth? Who funded the research, and what did those funders want? Who wanted what from their careers, and what influence might this have had? What was the psychological readiness of the source to accept and report on different findings that might emerge?

These are the questions I have been asking about skeptics' arguments. They can sometimes pass the first test, but every single one of them fails at least one of the final three.

A few years back, just before I reoriented my working life toward addressing climate change, I thought I'd better double-check that the whole thing wasn't a storm in a teacup. I didn't want to go to a whole lot of trouble for nothing. I knew my family was going to have to put up with my hardly earning anything for a year or two while I learned a new trade.

A good friend of mine had raved about Bjørn Lomborg's book *The Skeptical Environmentalist*. "Mike," he said, "I've read this book and it's rearranged my thinking." It's a thick and persuasively written tome with some 2,000 academic references. It makes the claim that we can all afford to chill out about climate change and we would do better to invest the money elsewhere. Lomborg further asserts that the climate change worriers are psychologically wedded to a doom-and-gloom position on life. To me, that last point hit a nerve. It was an important challenge to address. I thought, "Perhaps he's right! Maybe I should ask myself if this applies to me?" I didn't want the experience of realizing in years to come that the only reason I've done all this stuff about climate change is because of some unhealthy personal hang-up. At the very least I felt that the mainstream scientific community should have a blisteringly clear response to Lomborg, and it was disquieting that I couldn't readily find one.

I sat down to spend a week with Lomborg's work. I picked into some of his arguments in detail and before long found that even from my distant position I could see several clear misrepresentations of science. Then I found that his book had never been appropriately peer-reviewed. Then I started uncovering websites that detailed his errors literally in their hundreds, along with roasting dismissals of his arguments from scientists, statisticians, and economists alike. After that I started to read about Lomborg's close shaves with the Danish Commission for Scientific Dishonesty. In the end it was abundantly clear to me that the whole thing was a sham. I came to a clear view, but it took detailed consideration of his work — far more than can be expected of the average person on the street.

Lomborg passed the first and third of my tests but failed the second and fourth. To this day Lomborg carries on and has a following. It is incredibly unhelpful for the world. I don't know any scientists who have any time for his position at all, although some commentators treat his work with unwarranted respect in the misguided name of "balance" or perhaps just to be polite.

In the name of open-mindedness I've looked in detail at several other "skeptics" and had a similar experience.

So much for the skeptics. Let's look at the mainstream

scientific community. The UN's Intergovernmental Panel on Climate Change consists of around 2,500 scientists. The skeptics point out that there may be potential for group-think and mass hysteria. These are warnings that should be taken seriously. Furthermore, there have been occasional errors in the IPCC's work, and even the hint of the odd deliberate misrepresentation. However, the standard of integrity that is demanded of the climate change believers is on a different plane altogether from that demanded of the skeptics. Some scientists at the University of East Anglia have been in world headline-hitting trouble for allegedly "sexing up" their work in a way that some of the skeptics would consider quite normal. The resulting scandal, which turned out to be about not all that much, has been hugely damaging to popular understanding of climate science.

It's worth bearing in mind that it would also be possible to criticize the IPCC for its caution. Does it offer a sufficient platform for the airing of discomfort about poorly understood scientific risks? Does the level of deliberation and the need for consensus among such a wide community, some members of which clearly have been under political pressure to play things down, result in an undercooked estimation of the risks? We can't know for sure. We do know that the extent of scientific consensus is almost unanimous in affirming [that climate change is a big deal and that it is caused by humans].

Finally I want to note a trend that I have also picked up on among the people I know. The more scientifically minded they are and the more they have thought about the issues, the more worried they tend to be that even though we might almost all be fine, it is also just as likely that we'll end up frying in our billions. I talk to a lot of academics, mainly physical scientists and social scientists. In the last few weeks I've started conducting my own informal opinion poll by asking any senior academic that I meet to estimate the percentage of people in their department who think that "climate change is a big deal and is caused by humans." So far I have yet to have anyone give me a figure under 99 percent. It is an amazing phenomenon that people within the academic community, those with the most realistic and mature understanding of how the academic process works and of how scientific knowledge evolves, are so clear … [that climate change is a big deal and caused by humans] while the wider public remains so obstinately doubtful.

Can we do something about it?

People ask me sometimes why they should bother when, even if everyone in their country cut the carbon, it would

make such a small impact on world emissions. Sometimes I hear businesspeople trying out the argument that their hands are tied until governments act or until their end consumers care more. Governments say they can't move ahead of popular opinion. I hear Chinese people saying that the developed world started it and is more carbon hungry, so they should start the cuts, whereas in the U.K. I hear people saying we're just a pinprick in comparison with the U.S. or the emerging Chinese middle classes.

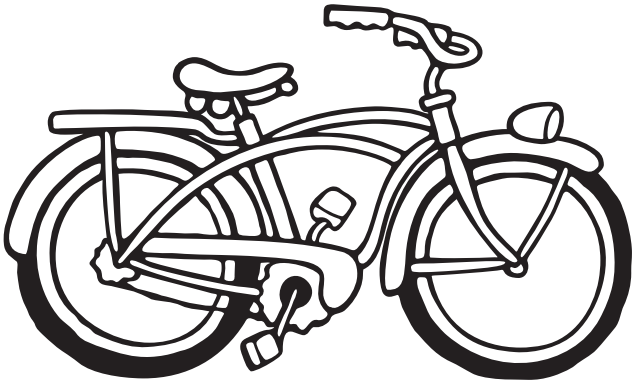
The UN climate negotiations in Copenhagen and elsewhere have surely taught us that it isn't enough to hope that world leaders will sort things out on their own. So the question is, Where does leadership come from? My answer is that it can come from anywhere, and we need it to come from everywhere at once. If the Chinese middle class wants a Western lifestyle, the Western lifestyles had better become lower carbon. Who can start that off? Anyone can. Anyone who finds a way of enjoying life more for less carbon is setting a standard for others. Anyone who chooses a lower-carbon food is helping the supermarkets to emphasize that product. Any supermarket that improves and promotes its lower-carbon range is helping its customers to enjoy low-carbon food. All of this helps the political parties to move into a low-carbon position.

If you can find a way of being happier but with a smaller footprint, you are a leader.

Mike Berners-Lee is a leading expert in carbon foot-printing. He is director and principal consultant at Small World Consulting. This excerpt is from his 2010 book *How Bad are Bananas? The Carbon Footprint of Everything.*

"It takes as much energy to wish as it does to plan."

— ELEANOR ROOSEVELT



CELEBRATION And Call to Action

"The character of a whole society is the cumulative result of countless small actions, day in and day out, of millions of persons."

— Duane Elgin

This optional final session is an opportunity to celebrate the completion of this course, reflect upon your experience and discuss future actions you can take individually and as a group. Many discussion groups choose to share a potluck meal together as they discuss their experience and decide what they will do next. Prior to this session, please make sure to complete the evaluation form on page 9 and bring it to the meeting or submit the online evaluation found at www.nwei.org/discussion_courses/course-offerings/powering-a-bright-future.

In addition to making changes in their own lives, group members often want to work together on a project. Should your group feel motivated to take on a collective project, the following list highlights some actions taken by groups that have completed NWEI courses:

- Schedule a monthly potluck, hike or other group gathering to continue engaging with each other and supporting each other's behavior changes.
- Take the Northwest Earth Institute's four week discussion course on climate change: *Global Warming: Changing CO_2urse*. Visit www.nwei.org for more details or to order a copy.
- Commit to conducting an energy or a waste audit for your homes, workplaces, schools, or places of worship.
- Attend a local or regional planning meeting to weigh in on energy or transportation concerns.
- Start a letter writing campaign to leaders advocating for the changes you wish to see.
- Volunteer for a campaign to elect a public servant committed to clean energy.
- Organize an event with a speaker or hold a film screening to promote awareness of energy and climate. See NWEI's film recommendations on our website at www.nwei.org/discussion_courses/course-offerings/powering-a-bright-future.

Once your group decides which project you'll undertake,create a specific follow-up plan and delegate responsibilities.

If you are interested in offering or participating in other NWEI discussion course programs, please visit www.nwei.org for a complete list of course offerings. At our website you can also support this work by becoming a member of the Northwest Earth Institute, joining our email list or reading our blog.

Thank you for your participation; we sincerely hope this discussion course was an enriching and inspiring experience for you!

Become a Member of NWEI

Inspiring people to take responsibility for Earth.

Thank you for participating in this Northwest Earth Institute discussion course!

If you would like to help others discover their role in fostering sustainability, please consider joining NWEI as a member. Thanks to our members, we are able to reach communities across North America in an effort to create a sustainable future for us all.

Member benefits include a subscription to our *EarthMatters* newsletter, and special members only discounts and promotions on coursebooks and NWEI conferences.

To join, fax this form to (503) 227-2917, or mail to Northwest Earth Institute; 107 SE Washington St., Suite 235, Portland, OR 97214. You can also join online at www.nwei.org/join.

☐ **I'd like to make a tax-deductible donation to become a member of the Northwest Earth Institute.**

Name _____

Address _____

City _____ State _____ Zip code _____

Telephone: Day (_____) _____ Evening (_____) _____

Email address _____

Membership:

☐ Regular $35
☐ Household..... $50
☐ Earth Steward $100
☐ Sustainer.....$250
☐ Patron.....$500
☐ Founder's Circle $1,000
☐ Other amount ..... $_____

☐ **I'm already a member. Here's an additional gift. $_____**

Pay by credit card: ☐ Visa ☐ MasterCard

Card number _____ Expiration date _____

Signature _____

☐ **I would like information on NWEI's other programs. Please send me information about:**

☐ A World of Health: Connecting People, Place and Planet
☐ Choices for Sustainable Living
☐ Discovering a Sense of Place
☐ Global Warming: Changing CO_2urse
☐ Healthy Children — Healthy Planet
☐ Hungry for Change: Food, Ethics and Sustainability
☐ Just Below the Surface: Perspectives on the Gulf Coast Oil Spill
☐ Menu for the Future
☐ Reconnecting with Earth
☐ Sustainable Systems at Work
☐ Voluntary Simplicity

Thank you for your support!
Become a member or renew your membership online at www.nwei.org/join.
Northwest Earth Institute, 107 SE Washington Street, Suite 235, Portland, OR 97214

PERMISSIONS

Session 1

"Making Sense of Peak Oil and Energy Uncertainty" by Daniel Lerch. Original appeared in *The Post Carbon Reader: Managing the 21st Century's Sustainability Crises*, by Post Carbon Institute, edited by Richard Heinberg and Daniel Lerch. Published 2010 by Watershed Media in collaboration with Post Carbon Institute. Used with permission of Post Carbon Institute.

"Solar Power Off the Grid: Energy Access for World's Poor" by Carl Pope, Yale Environment 360, January 4, 2012. Used with permission of Yale Environment 360. http://e360.yale.edu

"Fracking Democracy" by Sandra Steingraber, *Orion* magazine, January/February 2011. Used with permission of *Orion* magazine and the author. www.orionmagazine.org/

"Would the World Be Better Off Without Nuclear Power?" by Amory Lovins. Used with permission, Ó Rocky Mountain Institute 2011. For more information, see www.RMI.org.

"Scrapping Fossil-Fuel Subsidies Would Get Us Halfway There on Climate Change" by Brad Plumer, *The Washington Post*, January 20, 2012. Used with permission of PARS International.

"Energy Subsidies Black, Not Green." Copyright© 2009 Environmental Law Institute®, Washington, DC. Reprinted with permission from ELI®.

"Climate Proposal Puts Practicality Ahead of Sacrifice" by John Tierney, *The New York Times*, January 16, 2012. Used with permission of *The New York Times*, www.nytimes.com.

"U.S. Carbon Emissions Down 7 Percent in Four Years: Even Bigger Drops Coming" by Lester Brown. Used with permission of Earth Policy Institute, www.earth-policy.org/

"$4 Gas" © Ed Stein. Universal Uclick. Used with permission.

Session 2

"Peak Oil: A Chance to Change the World" by Richard Heinberg, *YES! Magazine,* May 2011. Reprinted with permission of YES! Magazine, www.yesmagazine.org

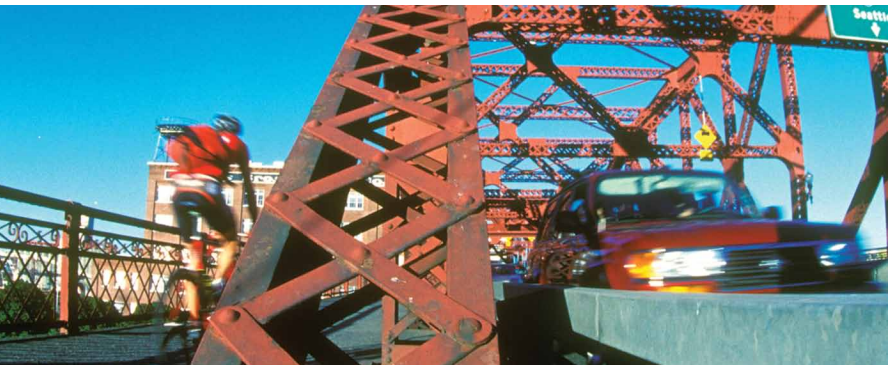
"Henry Red Cloud: Warrior for Native America" by Talli Nauman, *YES! Magazine,* December 2011. Used with permission of *YES! Magazine,* www.yesmagazine.org

"Energy Efficiency," excerpted from Chapter 8 of *World on the Edge* by Lester R. Brown. Published 2011 by W.W. Norton & Co., NY. Used with permission.

Excerpts from the book *How Bad Are Bananas?: The Carbon Footprint of Everything,* by Mike Berners-Lee, published 2011 by Greystone Books: an imprint of D&M Publishers, Inc. Used with permission from the publisher.

"Why 16 Year-Old Alec Loorz is Suing the Government" by Alec Loorz, *GOOD Magazine*, May 4, 2011. Used by permission of the author.

The EcoChallenge is an opportunity to change your life for good. For two weeks every October, we challenge you to change one habit for Earth. You choose your challenge, we connect you with other EcoChallengers, and collectively, we prove that small actions add up to real change.



www.EcoChallenge.org

NORTHWEST EARTH INSTITUTE COURSE OFFERINGS:

A World of Health: Connecting People, Place and Planet
Choices for Sustainable Living
Discovering a Sense of Place
Global Warming: Changing CO2urse
Healthy Children, Healthy Planet
Hungry for Change: Food, Ethics and Sustainability
Just Below the Surface: Perspectives on the Gulf Coast Oil Spill
Menu for the Future
Powering a Bright Future
Reconnecting with Earth
Sustainable Systems at Work
Voluntary Simplicity

Inspiring people to take responsibility for Earth.

Northwest Earth Institute
107 SE Washington, Suite 235
Portland, OR 97214
(503) 227-2807
FAX: (503) 227-2917
EMAIL: contact@nwei.org
WEBSITE: www.nwei.org