

POWERING A BRIGHT FUTURE

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

— ELEANOR ROOSEVELT



POWERING A BRIGHT FUTURE



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By



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

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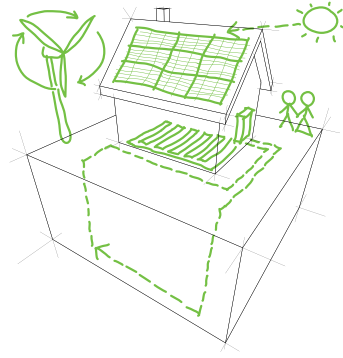
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Curriculum Development: Lacy Cagle

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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 CO₂ course* 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 ExtractionY 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 ChangeY N
 - Climate Proposal Puts Practicality Ahead of SacrificeY 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 WorldY N
 - Henry Red Cloud: Solar Warrior for Native AmericaY N
 - Excerpts from "Energy Efficiency"Y N
 - Low-Carbon Food TipsY N
 - Why 16 Year-Old Alec Looz is Suing the GovernmentY 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: _____
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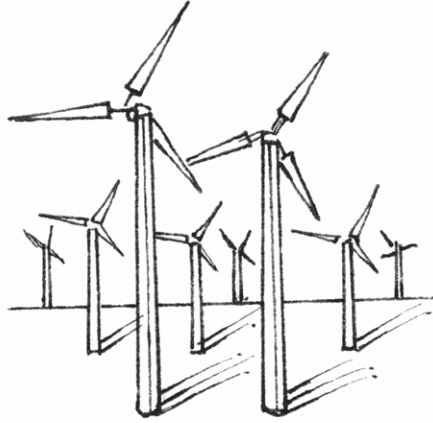
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NAME: _____
 ADDRESS: _____
 CITY, STATE, ZIP: _____
 PHONE (H): _____ PHONE (W): _____
 E MAIL: _____

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/nwestearthinstitute



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 CO₂, which can lead to global warming and associated climate changes when atmospheric concentrations of CO₂ 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 CO₂ when burned, but produces less CO₂ 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,

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	CO ₂ 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

may never see them) to respond at a sufficient scale to the multifaceted threats posed by peak oil.

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
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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
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ONLY A FRACTION OF U.S. CONSUMPTION AT 8% TOTAL

1%	53%	11%	3%	31%
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CONS

Considered one of the more costly energy options, isn't very reliable and additional transmission infrastructure is often needed	Still produces greenhouse gasses and can redirect agricultural activities away from food production, increasing food costs	Can require expansive distribution infrastructure 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.
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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
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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
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STILL DOMINATES U.S. ENERGY CONSUMPTION

37%	21%	25%	9%
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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
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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