Catholic Moral Traditions and Energy Ethics for the Twenty-First Century

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IN THE PAST TWO HUNDRED YEARS, the rapid extraction and combustion of fossil fuels have contributed to anthropogenic interference in global climate systems, while also increasing net global wealth and some forms of economic development. In the twenty-first century, it is now clear that fossil fuel sources have both positive and negative impacts on economies, livelihoods, and environments worldwide. What might formal Catholic teaching and theological-moral reflection offer to this situation?

The institutional Catholic Church has engaged energy issues in multiple documents, ranging from papal encyclicals to the U.S. Bishops’ 1981 statement on energy. So too have discussions of fossil fuels, climate change, and ethics occurred within broader scholarly discourses of Catholic theology and ethics. Catholic organizations dedicated to the global common good and to countering the effects of climate change have proliferated in the U.S. and worldwide. This essay builds upon the growing ecclesial, scholarly, and practical attention to these issues by revisiting the U.S. Bishops’ 1981 statement on energy, “Reflections on the Energy Crisis,” in recognition that the question of what powers societies in the twenty-first century is not merely an issue of technology or economics: It is also an issue of energy ethics. A Catholic energy ethics requires attention to current energy realities.


with scientific and technological precision, and can offer unique clarity about the specifically moral character of the problem.

Today economies and cultures are increasingly globalized. Few actions have strictly local effects. Thus globalization increasingly interlinks the private and social spheres of action, forming the present reality of “moral globalization,” which increases the moral responsibility of all persons to act with integrity and recognize the global impacts of their personal and collective actions. The environmental crisis of today is the unintended result of the history of these impacts. As Pope Saint John Paul II wrote, “Today the environmental crisis has reached such proportions as to be the moral responsibility of everyone.”

In light of the impacts of fossil fuels on climate systems, and the differential distribution of economic and environmental benefits and burdens, we believe that the wise and appropriate use of energy sources is necessary to generate a sustainable and just energy future. Insofar as the United States represents a considerable proportion of global energy consumption as a “super-developed” nation, it is essential for the U.S. to show prudence and responsibility in its long-term energy policies. One resource for public discussion and consideration about the shape of twenty-first century energy policies is the 1981 U.S. Bishops’ statement on energy.

This article first contextualizes the U.S. Catholic Bishops’ 1981 report, articulates its enduring principles, and notes developments in the global energy situation since 1981. Subsequent sections constructively engage the Bishops’ document, analyzing energy sources and technical, economic, and ethical considerations in a parallel structure to the 1981 statement: Energy of the Past (Fossil Fuels); Energy of the Present (Bridge Fuels); Energy of the Future (Renewables). For each category, we offer an overview of opportunities and challenges, articulate distinct issues, offer important guiding principles, and suggest ways forward in making the transition to a more sustainable, just, and renewable energy future. The essay concludes with suggestions about global leadership and intergenerational responsibility.

The primary authors are United States residents and scholars of Catholic theology, Catholic social teaching, and environmental ethics at five universities whose integrative, analytic, and constructive work

here builds upon a series of working group meetings and reports by contributing authors made at the Catholic Theological Society of America since 2012. The first sections were drafted as commentaries on ten individual themes within the statement by ten scholars. These commentaries were shared with outside experts for independent review, and the primary authors crafted these commentaries into the current article. Additional scientists, economists, policy experts, and industry leaders gave their time generously to review sections of this essay for scientific accuracy and interdisciplinary rigor.


The context for the Bishops’ 1981 “Reflection on the Energy Crisis” was the growing scarcity of oil, geopolitical tensions, price shocks,

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6 The reviewers listed here read one or more of the original commentaries or the draft of the final synthesized document, and the authors express their gratitude to each for their comments and insight. These are: Dr. Shahzeen Attari, Indiana University School of Public and Environmental Affairs, Purdue University; Dr. Sandra Baptista, Senior Research Associate, Center for International Earth Science Information Network, Columbia University; Patrick Doherty, Senior Fellow of the International Security Program, New America Foundation; Rev. Fletcher Harper, Executive Director, GreenFaith; James E. Hug, S.J., Spiritual Life Department, Adrian Dominican Sisters, Adrian, Michigan; David Lochbaum, Director of the Nuclear Safety Project of the Union of Concerned Scientists; Dr. John Mutter, Professor of International and Public Affairs; Professor, Earth & Environmental Sciences, Columbia University; Dawn M. Nothwehr, OSF, Ph.D., The Erica and Harry John Family Endowed Chair in Catholic Ethics, Catholic Theological Union; Dr. Robert Pollack, Professor of Biology, Columbia University; Dr. Veerabhandran Ramanathan, Distinguished Professor of Atmospheric and Climate Sciences at the Scripps Institution of Oceanography, University of California, San Diego, Council member of the Pontifical Academy of Sciences; Dr. Sunny Ramchantani, Global Energy Initiative and Falcon Energy; Dr. William H. Rauckhorst, Professor Emeritus of Physics at Miami University of Ohio; Natabara Rollosson, consultant for United Nations Development Programme, United Nations Executive Office of the Secretary-General, United Nations Climate Change Secretariat; Dr. Kristin Shrader-Frechette, Ph.D., O’Neill Family Endowed Professor, Departments of Philosophy and Biological Sciences, University of Notre Dame; Dr. Anthony Strawa, NASA Research Scientist, Lead- Aerosol and Cloud Microphysics Group, Atmospheric Physics Branch, Earth Sciences Division; Rear Admiral David W. Titley, USN (Ret) past leader of the U.S. Navy’s Task Force on Climate Change, now Director of the Center for Solutions to Weather and Climate Risk at Pennsylvania State University and Adjunct Senior Fellow at the Center for New American Security; Dr. Pablo Wangermann, Client Principal, Aerospace & Defense, HP Enterprise Services. All analyses, opinions, and errors are our own and do not reflect the views of any of our expert reviewers.
and looming threats of economic and social chaos in the face of peak oil (the concern that the world’s oil resources were being tapped to their limits, would soon peak, and decline, leaving an energy shortage). Thus “Reflections on the Energy Crisis” emphasized conservation to preserve this finite source for the future, while developing alternative sources to assure energy availability for all people. The document was structured to address past, present, and future energy sources in light of foundational principles and practical queries.

Climate change was already recognized by scientists when the Bishops wrote in 1981, but it was at the margins of public awareness. In 1988 the Intergovernmental Panel on Climate Change formed, and in the following year the prominent educator and environmental activist Bill McKibben wrote the first mainstream book on climate change. Public awareness of the causes and scope of climate change have amplified dramatically in the intervening decades. Even in their 1981 statement, the Bishops recognized that “it would be the height of folly to tamper in ignorance with the ecology of the entire planet.” In 2014, that folly is fact. Attempts at global protocols, emissions caps, and mitigation schemes have been numerous, yet not well supported by the United States and some other highly industrialized nations. So too has the threat of diminishing fossil fuels shifted somewhat since 1981, as unconventional sources (such as tar sands and shale oil reserves) have become more economically feasible to tap. Moreover, an ethical concern has emerged forcefully: Human-induced changes to the climate system bring multiple consequences, including unequal global patterns of distribution of the fossil fuel economy’s benefits and burdens. The Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change (IPCC) reports that without a change in society’s dependence on fossil fuels, severe disruption of ecological, social, and political systems will occur worldwide. The IPCC concludes that a world temperature increase of 2°C or more will create climate instability, diminished environmental resiliency, human suffering and displacement, and geopolitical strife as conditions such as drought, storms, and biodiversity loss alter traditional human lifestyles, habitations, cultures, and economies.

While all humans will be affected by climate change, the lack of access to energy will make the poorest three billion especially vulnerable to extreme events with devastating consequences. This is additionally problematic since the developing world contributed the least

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to the build-up of the heat-trapping greenhouse gases in the atmosphere. The United States is responsible for 26% of the CO$_2$ emissions from 1751-2012, while China is responsible for nearly 11%, India is responsible for 3%, and the whole of Africa is responsible for 2.6%.\(^9\) Long-term sustainable development must include the transition of existing fossil fuel economies to renewable energy systems, in both industrialized and industrializing contexts. Yet significant responsibility and leadership must fall to the developed nations who have already benefited from the exploitation of fossil fuel resources.

To be sure, communities in the United States face many challenges in the contemporary energy economy, including access to affordable, clean energy. Low-income and minority communities are disproportionately burdened by pollution and toxic waste sites, leading to asthma, learning disabilities, school absenteeism, and other illnesses.\(^10\) Yet the United States also understands itself as a land of opportunity, ingenuity, entrepreneurship, and resourcefulness. Generations of people committed to civic life, technological innovation, and global participation have focused scientific resources on the technological triumphs that advance human comfort and wellbeing. Their efforts launched outer space exploration, generating that enduring image of the “Earthrise;”\(^11\) revolutions in electronic and digital technologies have multiplied global interconnections. These and other scientific, technical, economic, and political developments created new possibilities for reframing human societies’ relationships. We think that energy is the necessary revolution for the present generation; and not only is it possible, its foundations are already present.

What the U.S. Bishops recognized in 1981 as largely a problem of finite supply is now augmented by problems of sustainable development and global justice for present and future generations in an era of population growth, economic globalization, and environmental degradation. Within this context, the 1981 Bishops’ statement provides a moral framework that deserves attention and updating to address the current energy situation and urgent ethical concerns facing the world.


ENDURING MORAL PRINCIPLES FOR ENERGY ETHICS

Climate change already casts its shadow on our planet; the diverse impacts of pollution and the inequalities of energy access call for a new moral analysis, for an energy ethics. As many scholars have pointed out, climate change is complicated to theorize in existing moral frameworks. This is because its effects are indirect and non-localized; impacts occur at different places and times; those affected are often not those who cause the problem; carbon dioxide and other greenhouse gases (such as water vapor) are not necessarily in and of themselves “toxic,” even while amplified atmospheric concentrations outstrip the earth’s natural capacities to absorb these compounds. Furthermore, the processes that are driving climate change did not begin as deliberate attempts to harm the planet; indeed, the burning of hydrocarbons has accompanied most forms of human development. More recently fossil fuels have facilitated the industrial modernity that many residents of the globalized West inhabit.

Yet with today’s ever-increasing knowledge about the modes and causes of anthropogenic climate change comes a moral responsibility to address the worst of its impacts as well as its root causes. While advanced nations have made great strides in containing and minimizing localized pollution, international agreements have faltered, effective carbon reduction has been minimal, and industrializing nations accelerate the pace of atmospheric change catalyzed by developed nations. Given this complexity and scale, what can be said morally about the situation?

The Catholic Church is well positioned to provide a coherent energy ethic to its many practitioners around the world. Moreover, as privileged North Americans, we think that solidarity requires that those living within the upper echelons of economic globalization respond to the global situation while acting in our geographical and national context. Our essay addresses itself squarely to U.S. Catholics; indeed, it may be said that middle and upper-middle class Americans are the single most important group of people to “convert” on issues of energy ethics, because—as many contemporary ethicists agree—they “probably have much more economic power than the vast majority of people on the planet.”

The Catholic Church has with increasing frequency pointed out that climate change is not a partisan issue; neither is it solely a political, economic, or technological issue. Instead, climate change is a human

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issue, linked to the security and flourishing of all the families and living communities of the earth.\textsuperscript{13} From this perspective, moral and religious traditions have significant resources to offer to grounding and framing an energy ethics. Official, institutional Catholic social teaching (CST)—a tradition dating in its modern form to 1891—does not provide alternative economic or scientific theories, but rather engages social realities by applying moral principles and moral vision emphasizing the one human family and the unity of creation. Since at least 1967, Catholic social teaching has explored intersections among social well-being, economic development, and environmental degradation; it includes speeches and writings by papal authorities, from the Pope himself to various agencies such as the Pontifical Council for Justice and Peace, as well as subsidiary ecclesial bodies such as national conferences of Bishops. Climate change has been increasingly attested in this literature. In 2001 the U.S. Bishops remarked: “At its core, global climate change is not about economic theory or political reforms… it is about the future of God’s creation and the one human family.”\textsuperscript{14}

Theological traditions seeking justice need prophets as well as careful, sophisticated analysts who are accountable to the most authoritative data and that attend to specific contexts. Thus a Catholic energy ethics needs to be tough-minded in at least two senses: it needs to be based on the most rigorous scientific understanding, and it needs to be pragmatic. While CST as formally understood refers to a body of texts generated by the magisterium, the broader conversations about Catholic social thought and environmental ethics are crucial sites of agency for lay people with multiple forms of expertise.

The call to live out an energy ethics proceeds from the universal call to holiness. The Vatican II document \textit{Lumen gentium} insists that the laity, just as much as those called to ecclesiastical vocations, have a “vocation to perfection” (no. 32), one in which they together “seek the kingdom of God by engaging in temporal affairs and by ordering them according to the plan of God” (no. 31). The laity are to “learn the


deeper meaning and the value of all creation, as well as its role in the harmonious praise of God,” as well as “remedy the customs and conditions of the world, if they are an inducement to sin” (no. 36). Thus, the vocation of the laity combines intense learning with forthright criticism of structures of sin.¹⁵

In 1981, the U.S. Bishops aimed “to situate energy issues in a moral context, to arouse sensitivity to human considerations that are often ignored.” The statement develops that claim by laying out six principles to guide reflection on specific aspects of that crisis. These foundational principles provide the starting point for our reflection and can be summarized as follows:

1. Cherishing and protecting life as a gift from God.
2. Accepting an appropriate share of responsibility for the welfare of creation.
3. Living in solidarity with others for a common good, namely, the sustainability of an abundant earth.
4. Striving for justice in society.
5. Giving special attention to the needs of the poor and members of minority groups.
6. Widespread participation in decision-making processes.

The energy ethics framework set forth here builds upon these principles, and adds a seventh from more recent magisterial teaching. We express the principles adapted to developments in the Catholic social teaching tradition and today’s specific energy contexts as follows:

1. *Cherishing and protecting life, health, and the conditions that support human and ecosystemic well-being in the present and for future generations.* The protection of life and health requires affordable, accessible energy and clean, safe water. Energy systems that destroy the homelands and livelihoods of people in diverse places around the world contradict the protection of life. Life itself relies on a broader ecological balance that transcends geographic and temporal boundaries, and includes the conditions that support all of life on earth, now and in the future.¹⁶
2. *Accepting an appropriate share of responsibility for climate change, with a strong sense of duty to ameliorate its worst effects as well as to address its root causes.* Accepting an appropriate share of responsibility means that U.S. residents and communities must acknowledge their historical contribution to the accumulation of greenhouse gases, including current per capita usages and

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¹⁶ The natural order and balance of creation is often expressed in Catholic teaching as the “grammar” of creation; see Benedict XVI, *Caritas in veritate*, no. 48.
political-economic structures that benefit vested interests instead of the common good. Our duty is to address root causes by means that are not merely economic or technical, but also moral and educational.

3. **Seeking a common good that lives in solidarity with others to promote genuine, shared flourishing.** Preserving the common good calls us to recognize that energy systems are changing, and must be changed. We must immediately take every action to shape energy systems that support flourishing communities. We believe that our ultimate happiness and security comes from God, who has endowed us with the privilege and responsibility to be the guardians and protectors of creation. As a spiritual invitation, this is a call to refocus on family and community, on time spent in recreation, not endless overwork, consumption, and economic expansion. A genuinely shared common good comes from a shared life of balance, sufficiency and seeking joyful living with friends and family. “Super-developed nations” have a special obligation to stand in solidarity with other nations and marginalized peoples. Contributing to the development of new energy systems and economies is an important task of solidarity that shapes communities in which all flourish.

4. **Promoting distributive justice: In striving for a more just society, Catholics are called to create energy systems that are both fair and sustainable.** The 1981 statement paraphrases Pope John XXIII, insisting that “the economic prosperity of any people is to be assessed not so much from the sum total of goods and wealth possessed as from the distribution of goods according to norms of justice, so that everyone in the community can develop and perfect themselves” (no. 74). This standard of distributive justice suggest that our current measures of economic prosperity be adjusted. Rather than promoting individual maximizing of excess luxury, everyone should be enabled to live a decent life. We have enough energy to go around, but currently it is distributed in unjust ways.

5. **Orienting justice towards a preferential option for the poor and future generations to ensure universal access to sustainable energy for basic needs.** Current measures of economic prosperity should be adjusted towards integral development that provides

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18 Pope John XXIII in *Mater et magistra* (http://w2.vatican.va/content/john-xxiii/en/encyclicals/documents/hf_j-xxiii_enc_15051961_mater.html) elaborates on the point: “From this it follows that the economic prosperity of a nation is not so much its total assets in terms of wealth and property, as the equitable division and distribution of this wealth” (no. 74). Pope John XXIII references similar teaching from Pope Pius XII, underscoring the consistent magisterial teaching that prosperity must include the equitable distribution of wealth.
sufficient resources for the poorest members of society. This is vital because the greatest effects of climate change impact poor nations whose members have contributed virtually nothing to the problem. Moreover, in our own society, we must address the problem that environmental action too often appears as a cause for the wealthy, without placing heavier burdens for change on those already suffering from relative energy poverty. Access to sustainable energy systems should be available to all, so that the poor are not forced to rely on the energy of the past.

6. **Enabling participation through subsidiarity and ensuring transparency when accounting for the benefits and burdens of energy options.** Sufficient participation in energy decisions requires transparency and full-cost accounting of the impacts of various energy options. Energy firms have a legitimate right to reasonable profit, but not to a maximum profit made possible by minimizing safety regulations and overlooking the common good. Transparent communication of energy risks and costs is essential and any manipulation of information infringes upon the rights of citizens to self-determination.

7. **Developing technological prudence.** Recent Catholic thought has put a new emphasis on the limits of technological solutions. Pope Benedict XVI taught that “the development of peoples goes awry if humanity thinks it can recreate itself through the ‘wonders’ of technology” (*Caritas in veritate*, no. 68). Technological innovation is a marvelous human capacity, but unintended consequences are common, and technical interventions are only as good as the social frameworks within which they are deployed. A misplaced conviction of technological determinism—what CST has called an idolatrous “faith in progress”—believes science will allow humans to create “a totally new world.”

This trust that any and all ecological problems can be met by some future technological solution, however fantastic or dangerous, is misplaced. As a result, the precautionary principle should guide energy ethics.

**ENERGY OF THE PAST: FOSSIL FUELS**

Fossil fuel extraction and combustion have supported a world unimaginably transformed from even a few centuries ago. The energy produced from these sources has been transformed into health, light, comfort, and reduced labor for billions of people around the world. Energy is an essential, life-giving reality that creates industrial modernity as we know it. However, fossil fuel infrastructures, their processes of extraction and combustion, cause irreversible damage to our climate and our earth. Transitioning to an economy that bridges fossil fuels and renewables is an enormous challenge, but an essential task. What

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do we make of fossil fuels that have powered societies and economies for the past several hundred years, and why might they rightly be seen as “energy of the past”?  

**Fossil Fuels and Carbon Budgets**

The Catholic Church recognizes the scientific consensus that human-induced changes to climate are measurable, attributable to the burning of fossil fuels, and that an ethical response is required. While the Bishops’ 1981 statement focused on the context of peak oil, today the global carbon budget and amplified feedback cycles (meaning the intensification of effects in the coming decades and centuries) are of chief concern. Atmospheric carbon dioxide (CO₂) would decline rapidly if fossil fuel emissions were to be instantly terminated—a counterfactual proposal, to be sure, but an important baseline for calculations. Halting emissions in 2015 would allow atmospheric CO₂ to decline to 350 parts per million (or “ppm,” signifying a ratio of carbon dioxide molecules to all of the other molecules in the atmosphere) at century’s end. Some scientists argue that with a tightened carbon budget and improved forestry and agricultural practices, global temperature rise might only be 1°C by the end of the century as long as there is no net increase of non-CO₂ greenhouse gases. Thus scientists and policymakers increasingly speak of a carbon budget for meeting certain temperature targets.

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22 The World Bank, “CO₂ emissions (metric tons per capita),” http://data.worldbank.org/indicator/EN.ATM.CO2.E.PC. One calculation of the global carbon budget is expressed in terms of carbon dioxide as 750 Gt CO₂. By dividing this budget of 750 Gt CO₂ among all countries on an equal per-capita basis based on their population for 2010, national CO₂ budgets are identified. With a global population of 6.9 billion in 2010, the U.S.’s average annual per-capita emissions is 2.7 tons of CO₂ until 2050. For comparison, the U.S. per capita emissions in 2009 was 17.3 tons.
When viewing the carbon budget in terms of per capita emissions, the United States’ carbon budget is almost exhausted. There are proposals to create an international trading emissions system that would allow the U.S. to buy carbon credits from other developing countries. Proponents suggest such proposals would allow developed countries like the United States leeway in its process of radical emissions reduction, while allowing developing countries the possibility of economic benefit.

Carbon budgets demonstrate the practical and ethical necessity of transitioning away from carbon-based energy sources. Continued expansion of unconventional fuel sources such as tar sands and tar shale, hydraulic fracturing (commonly referred to as “fracking”) for oil and gas, coal mining, and drilling in the Arctic, Amazon, deep ocean, and other remote regions must be named for what they are: profit-seeking and polluting practices that do not contribute either to carbon reductions or to the transition to a renewable energy situation. The transition will entail both opportunities and costs to the current functioning of fossil fuel companies and economies, as social and environmental sustainability—not corporate profits that shift the costs of pollution to society—is the fundamental value that must be achieved. Thus U.S. energy policy at both govern-

Carbon companies can become partners within a clean, prosperous, and healthy economy as energy companies, not fossil fuels companies. The conventional fossil fuels that remain within a safe global carbon budget must be directed toward building a clean energy infrastructure. The stable pricing of carbon is a widely-recognized and recommended means to incentivize sustainable choices. Currently available technologies can assist developing nations.

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23 The U.S. population as of 2010 is estimated to be 4.6% of the world’s population. With that population as a reference the U.S. share of the global carbon budget between 2010 and 2050 is 35 Gt CO$_2$. Estimated U.S. emissions in 2008 were 6.1 Gt CO$_2$. If we assume annual emission do not increase or decrease from 2008, the United States’ carbon budget would be exhausted in a little less than 6 years. In sum, the carbon budget analyses from multiple scientists make vividly clear the implications of delaying a rapid transition away from fossil fuels. If emissions reduction had begun in 2005, reduction at 3.5%/year would have achieved 350 ppm at 2100. Now the requirement is at least 6%/year. Richard Miller, “Discussion of ‘Reflections on Energy,’” conference paper, Catholic Theological Society of America (June 8, 2014).

24 “Fracking” is used as an overall term to encompass vertical and horizontal drilling as well as the hydraulic fracturing process. Technical discussions make additional distinctions and seismologists note the hazards associated with injection wells where waste water is disposed of, including triggering small and moderate earthquakes. John Mutter, personal communication (October 4, 2014).
mental and corporate levels must drive a necessarily ambitious, purposeful path to a low carbon economy—what some theorists have referred to as a new “grand strategy.”

Making the Transition in the United States: Proposals and Technologies

In addition to addressing carbon budgets and permit trading, some policymakers propose that nations provide financial support proportionate to their historical emissions for mitigation and adaptation measures in developing countries. The cumulative historical emissions of a particular country are significant because of the long life of CO\(_2\). A widely-accepted policy proposal at present is a price on carbon, which raises the price on coal-fired electricity compared to solar, wind, hydro, or nuclear power, reducing demand for carbon-emitting products, reducing profits of fossil fuel producers, and incentivizing reduced consumption. While consumers would pay higher prices for fossil-fuel based electricity or home heating, the revenues gained by pricing carbon can be returned to the public through a dividend or by reducing payroll taxes. In contrast to subsidies, which are financed by the public, pricing carbon creates lower costs for those who purchase non-carbon emitting products and increases profits of those who produce them. Nor do carbon prices identify favorites among emerging technologies.

A carbon price eliminates uncertainty, creates a level playing field as it applies across the board, and avoids the question of whether too many permits in too few sectors are issued. Carbon prices incentivize sustainable behavior and disincentivize polluting behavior. One policy suggests a revenue-neutral upstream carbon tax, which returns money through tax reductions to corporations and individuals. This option reduces the corporate tax rate, reduces individual taxes, and compensates individuals for energy costs. Other policies advocate returning a dividend to consumers alone. However structured, the price must be high enough to drive down CO\(_2\) emissions.


28 George Frampton, Partnership for Responsible Growth, argues that returning carbon revenues to corporations and individuals increases GDP, growth, jobs, competition, and avoids new spending by government. See www.partnershipforresponsible
kept oil and gas prices artificially low “not only decreased incentives to conserve energy but also diminished the prospects for successfully developing and marketing alternative energy sources.”

*The Principles of Protecting Life and Solidarity*

Climate change is a tremendous threat to life, health, and wellbeing that affects Americans and our neighbors around the globe, necessitating a transformation to a low-carbon economy. Catholic teaching affirms that climate change is a life issue. Yet solidarity also requires that developing nations that have minimal access to fossil fuels—yet still emit dangerous short-lived climate pollutants—are able to climb out of energy poverty. Globally, the poorest billion depend on solid biomass or solid coal for their basic energy needs of lighting, cooking and home heating.

Clean energy for cooking and lighting for the “bottom” three billion people is currently available in advanced cook stoves and solar lighting. What is necessary is continued small-scale innovation, attention to political-economic realities, and technology transfer and access based on principles of justice and the preferential option for the poor. Micro-grid and off-grid solar power for accessing drinking water and irrigation water will reduce CO₂ and black carbon emissions from diesel generators. These technologies also empower women and contribute to positive economic growth through education and micro-finance, since the new technologies save each woman or girl about one to five hours of lost time collecting firewood.

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30 The Kevin Anderson and Alice Bows carbon budget notes that some greenhouse gases (i.e. methane and nitrous oxide) cannot be reduced to zero because of their necessary role in feeding a growing population. See Kevin Anderson and Alice Bows, “Beyond Dangerous Climate Change,” *Philosophical Transactions of the Royal Society* 369, no.1934 (January 2011): 31.

31 Veerabhadran Ramanathan, “The Two Worlds Approach for Mitigating Air Pollution and Climate Change,” in *Pontificale Academies Workshop: Sustainable Humanity, Sustainable Nature, Our Responsibility* (Vatican City, 2014), 2. For some in the highest 1.1 billion of the top four billion, this may mean reductions from as much as 50 tons/year.

32 Ramanathan, “The Two Worlds Approach for Mitigating Air Pollution and Climate Change,” 12. Ramanathan proposes a voluntary carbon market by which the top 1.1 billion earn credits in a carbon market by paying about $22 per person to purchase these clean technologies.

Action Items

The principle of subsidiarity requires that institutions and agents act at the most local level of society, then at incrementally higher levels, and petition for action at increasingly higher levels of governance to minimize the use of fossil fuels and mitigate their effects. Moreover, living out an energy ethics invites us to recognize ourselves as Catholics who are working for justice in our communities, in solidarity with people everywhere, for and with the poor who are most adversely affected by human-forced climate change, now and in the future. We must also recognize ourselves as working in solidarity with other species, their habitats, and our shared ecosystems toward a planetary solidarity.\textsuperscript{34}

All educated residents need to understand the full costs of energy and the present and future risks to climate and health. Counterfactual lobbying by science-denying groups and fossil fuel corporations must be exposed and ended. The full and transparent accounting of all costs of energy systems should be made available as a requirement of justice. Transparency means that the price of gas at the pump reflects the worldwide market price of oil, the costs of transporting oil safely worldwide, the costs of coal pollution, and the costs of the impacts of climate change. Policy leaders must also manage the risks of stranded hydrocarbon assets. Local leaders should work to identify effective solutions with input at the local level that support national goals.\textsuperscript{35} All should place the common good of the nation and earth above local interests and private luxury if its costs include climate impacts upon more vulnerable neighbors.

Twenty-four percent of the U.S. population identifies as Catholic.\textsuperscript{36} This community, its ecclesial governance, and all its leaders can draw on our traditions of moral reasoning to be a significant leader in the visible vanguard of a renewable energy revolution.

\textbf{Energy of the Present: Bridge Fuels}

In 1981, the Bishops rightly pointed out that, “cheap oil and natural gas not only powered the dramatic transformation of Western society in the 20th century, they underlie much of the material progress developing countries have made.” The question in 1981—and even more

\begin{itemize}
\item \textsuperscript{36} “U.S. Catholics: Key Data from Pew Research.” \textit{Pew Research Center} (February 25, 2013), www.pewresearch.org/key-data-points/u-s-catholics-key-data-from-pew-research/#popsize.
\end{itemize}
prominently today—is: what kind of energy framework will human societies deploy to build the future? This section considers two types of energy currently viewed as “bridge fuels:” shale gas via horizontal hydraulic fracturing and nuclear power.

**Natural Gas Extraction via Horizontal Hydraulic Fracturing**

Today, the escalating role of natural gas extraction via horizontal hydraulic fracturing is an example of unconventional development, which calls for moral values to clarify thinking about the future of the U.S. energy economy. In particular, the clear values of the precautionary principle, of informed and transparent decision-making, and of the Church’s advocacy about fresh water and human health are central considerations.  

Geological imaging has indicated that the natural gas and oil shale resources buried beneath the domestic U.S. are quantitatively dramatic, and some commentators predict that the fuel sources could power the entire U.S. for at least another century. Whether shale gas supplies are abundant or will diminish is difficult to predict. According to a geological expert cited in *Bloomberg View*, “Production from shale is not a revolution; it’s a retirement party.” If shale and gas decline due to the increasing cost of accessing it, as some predict, energy independence will require a more thorough diversification of the nation’s energy portfolio. Either way, the use of shale oil and natural gas found within the landmass of the U.S. is viewed by many as a desirable step towards energy sovereignty and global exports, thereby contributing in new ways to the U.S. economy. Energy companies are keen to develop more robust portfolios of fuels and fuel sources, especially with the advanced technologies and permissive regulatory climate which supports widespread fracking only in the U.S. and its northern neighbor, Canada.

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39 The average decline of the world’s conventional oil fields is about 5 percent per year. By comparison, the average decline of oil wells in North Dakota’s booming Bakken shale oil field is 44 percent per year. Individual wells can see production declines of 70 percent or more in the first year. Shale gas wells face similarly swift depletion rates, so drillers need to keep plumbing new wells to make up for the shortfall (Zeller, “Is the U.S. Shale Boom Going Bust?”).
While it is valuable to pursue the goal of energy sovereignty, any responsible conversation about fracking must ask: What scientific data do we have about fracking and its effects? What do we lack, why do we lack it, and what do we need to be sufficiently informed? At present, U.S. discourse on this extractive technology does not sufficiently meet the criteria of honest conversation. The permissive regulatory culture centers on a 2005 amendment to the National Energy Act—known colloquially as the “Halliburton Loophole”—that explicitly excluded fracking solutions from regulation, by the Environmental Protection Agency, by rendering the chemical contents of those solutions as “trade” secrets. This amendment has profoundly limited the regulatory and even investigative powers of the EPA and other entities into the downstream, potential long-term effects of whatever chemicals are used in fracking solutions. For environmental and public health reasons, it is important to know what is in fracking solutions, but by and large this information is unavailable.\(^{41}\) What is known is that between 2005 and 2009—that is, the first four years following the Halliburton Loophole—gas companies actively used over 2500 different fracking solutions, 650 of which included “29 chemicals that are (1) known or possible human carcinogens, (2) regulated under Safe Drinking Water Act for their risks to human health, or (3) listed as hazardous pollutants under the Clean Air Act.”\(^{42}\)

**Transparency: Full and Honest Disclosure.**

Chemicals used in fracking operations, the exact sites of usage, short and long-term toxicological and environmental effects, and the current limitations of our knowledge all need to be part of transparent, public conversation. This information needs to be available far enough in advance for the public to engage in meaningful research and reflection, and thereby to make decisions that reflect standards of informed consent.\(^{43}\) Chapter 10 of the *Compendium of the Social Doctrine of the Church* clearly states: “In the realm of technological-scientific interventions that have forceful and widespread impact on living organisms,

\(^{41}\) The registry, FracFocus (fracfocus.org), is largely voluntary or mandated on a state-by-state basis and cannot be searched in terms of chemical components of the fracking solution.


with the possibility of significant long-term repercussions, it is unacceptable to act lightly or irresponsibly.”44 The document also notes that “politicians, legislators and public administrators” must encourage—fairly and without special interest lobbying—“a correctly informed public opinion and make decisions that are best suited to the common good,” and not merely for the profit of corporations.45 Several practical implications follow. Insofar as the lack of scientific evidence is the result of the Halliburton Loophole, that loophole must be eliminated. Ongoing disclosure and stringent regulation of fracking chemicals at federal and state levels must follow. Until more is known definitively about the downstream effects of fracking, the precautionary principle holds that operations should desist. Only by looking at the big picture of value—not just short-term, shareholder-focused economic value—are we likely to achieve the human and ecological well-being that undergird any meaningful, long-term economic growth and independent, sustainable, energy future.

**Nuclear Energy**

In “Reflections on the Energy Crisis,” the Bishops questioned whether the United States should continue to rely upon nuclear fission to generate electricity. Approximately 12% of the electricity used in the United States in 1981 was generated by nuclear fission, whereas nuclear reactors generate 20% of the electricity used in the United

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States in 2014. The Bishops’ 1981 document raised many important questions about nuclear fission as a source of energy, several of which persist as particularly problematic.

**Highly Radioactive Waste**

The key moral problem with nuclear generated electricity is the accumulation of highly radioactive spent fuel at nuclear power plants throughout the United States because a system for isolating the used fuel from the biosphere has not been provided throughout the 60 years that nuclear plants have been generating electricity. In the absence of long-term disposal, most of the pools into which the used fuel is stored have been retrofitted to accommodate more densely packed spent fuel assemblies, while others have been placed in dry casks on concrete slabs where they continue to dissipate heat into the air. Federal officials have tried to identify a method for isolating the spent fuel for the long term, settled theoretically on a geological formation for a repository, and sought to site one that would prevent entry of the radiation into the biosphere. However, the burial of the spent nuclear fuel is fraught with difficulties that range from geological to ethical considerations. Before any more nuclear generating plants are constructed, a system for isolating highly radioactive used fuel must be functioning and capable of accepting all the used fuel that has been accumulating at existing facilities as well as the used fuel to be yielded by new facilities. The development and implementation of this requisite system must be accomplished in ways that protect the integrity of local communities and ecosystems now and into the future.

**Safety Concerns**

Also problematic today are safety concerns about nuclear leakage, spills, and explosions. The bishops raised these considerations even before the accidents at Chernobyl, Ukraine (1986) and at Fukushima, Japan (2011). Beyond the possibility of sudden catastrophes, the effects of low-level radiation on the health of uranium miners and others

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exposed to this element also correlate with increased rates of lung cancer and diseases in uranium miners and negative effects on DNA.\textsuperscript{48} Finally, the increased proliferation of nuclear weapons from the five nations noted by the bishops in 1981 (among the United States, France, China, the United Kingdom, and the Russian Federation) looms large in the present day, including in highly volatile areas of the world (India, Pakistan, North Korea, and Israel).\textsuperscript{49}

**MAKING THE TRANSITION:**

**“BRIDGING” TO A MAXIMALLY SUSTAINABLE ENERGY SYSTEM**

*The Carbon Savings of Natural Gas?*

While natural gas is often touted as being a “cleaner” energy source than traditional fossil fuels like coal, some scientific studies show that methane emissions from leaking gas wells counteract those benefits and may in fact amplify short-term global carbon concentrations.\textsuperscript{50} Unless such concerns are addressed, natural gas, which appears to be a “bridge” forward, may instead amount to business as usual.\textsuperscript{51} And while the shale gas boom has had a modest impact on emissions relative to the cuts needed to address climate change, some commentators suggest that perhaps “the greatest impact of shale gas may turn out to


A 2013 study by Climate Central, a group of scientists and journalists studying climate change, concluded that the 50 percent climate advantage of natural gas over coal is unlikely to be achieved over the next three to four decades.

be changing the political economy of introducing strong climate policy, making it easier for the Obama administration, for example, to propose regulations to reduce power plant emissions.\textsuperscript{52}


\textit{The Carbon Savings of Nuclear Energy?}

Nuclear energy has been vaunted as a low-carbon energy solution,\textsuperscript{53} which is desirable in the context of climate change since carbon-free energy solutions are essential to keep emissions below 450 ppm and global temperature increase below 2 degrees C. Because the IPCC predicts that under a business-as-usual scenario, the atmosphere will reach 450 ppm by 2030, nuclear power seems attractive from a carbon perspective. Yet given global historical trends in construction delays and costs, it is very unlikely that nuclear power can be brought to adequate scale by the IPCC’s target date of 2030.\textsuperscript{54} As Cornell engineering professor and former gas industry consultant Anthony Ingraffea warns, “unfortunately, we don’t have that long to address climate change—the next two decades are crucial.”\textsuperscript{55} In addition, there are dynamics internal to energy economies that shape the pace of development: U.S. Energy Secretary Ernest Moniz has opined that not Fukushima but shale gas has put the brakes on a U.S. nuclear renaissance.\textsuperscript{56}

Though some new nuclear technologies appear promising because they are anticipated as more cost-effective and safer than previous generations of infrastructure, these remain largely in concept or pilot

\textsuperscript{52} Jason Bordoff, “Why the Shale Revolution is More Boon than Bane,” \textit{Financial Times} (June 8, 2014), www.ft.com/cms/s/0/fcea14a2-e66d-11e3-bbf5-00144feabde0.html#axzz3bHj54Z2N.


\textsuperscript{54} The Keystone Report, a fact-finding report written jointly by nuclear industry and environmental leaders, states that maintaining the low-carbon benefits of international plants, many of which are scheduled to retire, requires an aggressive reactor building program. To build enough nuclear capacity to meet the carbon reductions of a Pacala/Socolow wedge, which is 1 GtC/year or 700 net GWe nuclear power, a rapid period of growth is needed that matches the industry’s most rapid historical period of growth (1981-1990), and then maintains this growth for 50 years. See Robert Socolow and Stephen Pacala, “Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies,” \textit{Science} 305 (August 13, 2004): 968-72. The Keystone Report assesses this projected rate of growth to be more optimistic than proposed plant construction validates, or that is forecast by the Energy Information Administration. Notable emissions result from mining activities, fuel fabrication (if not based on centrifuge enrichment), the transportation of fuel, materials and waste: see Sustainable Development Commission, “The Role of Nuclear Power in a Low Carbon Economy” (May 3, 2006), 19.

\textsuperscript{55} Ingraffea, “Gangplank to a Warm Future.”

stages and unready to serve in immediate strategies to reduce CO₂ by 2030. Private financiers and private industry continue to invest in the research and development of advanced, fourth-generation, small modular reactors. This is an appropriate role for private industry. However, public funding of costly and unproven technologies warrants high levels of transparency and public scrutiny, lest the public adopt the costs of stalled investments.

Even *The Economist* is skeptical about the potential for the development of a large market for small, rapidly mass-produced reactors theoretically free of construction delays, as such a market for competition does not exist. Finally, it is feasible that massive government investments in nuclear power may compete in detrimental ways with development of cleaner, renewable technologies. Especially if undertaken in the public sector, the massive sunk costs of multi-year investments in nuclear plants may lock out investments from decentralized technologies that already show significant advances, and divert funding from renewable technologies.

Cognizant of some of these trends, *The Economist* concludes that “in a low-emissions world, the role for nuclear will be limited to whatever level of electricity demand remains when renewables are deployed as far as possible.” Indeed, scientists urge rapidly deploying the many renewable wind, water, solar, and energy-efficiency technology options available now.

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The Principles of Participation and Prudence

In reference to both hydraulic fracturing and nuclear fission (as well as many other emerging types of energy generation), participation requires transparency, full cost accounting, and implementation of the “polluter pays” principle. Markets for energy should be shaped so that both producers and consumers pay the full cost of the energy they produce and use, thus incentivizing cleaner energy and conservation, but this must be done in ways that allow for a just distribution of energy resources. People living in poverty should not bear disproportionate burdens of increased energy costs.

For both fracking and nuclear technologies, problematic byproducts pose real toxicological threats. Natural gas and nuclear energy may provide bridges to a renewable energy future if, and only if, the virtues of prudence and justice are engaged by the U.S. to counter the imprudence and intergenerational injustice that has thus far prevailed. Environmental historians and contemporary demographers demonstrate that people living in poverty bear the biggest burden of environmental changes related to fossil fuel extraction, and negative externalities are unlikely to be shared evenly. With regard to natural gas extraction as well as nuclear fission, these “bridge fuels” must be built wisely and with attention to the ultimate destination of renewable, minimally-polluting energy sources and infrastructures that facilitate human and ecosystem flourishing.

Action Items

The precautionary principle enacts an appropriate concern about the integrity of water sources and human health, placing the pursuit of profit and economic growth as a secondary consideration. Citizens and policy makers must insist upon transparency regarding toxicological risks and other environmental, economic, and carbon-related externalities. The practical and prudent course is to deploy all renewable technologies as rapidly as possible, without waiting for a technological silver bullet, and to support distributed energy production in the developing world.63

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ENERGY OF THE FUTURE: RENEWABLES

The economic and technological capabilities of renewable energy have improved significantly since 1981. From an ecological standpoint, renewable energy is the most sustainable because it is generally cleaner than fossil fuels or nuclear energy, and some forms of renewable energy (especially wind and solar) are potentially inexhaustible. As the Bishops decreed in 1981, renewable energy “possesses key advantages over the rest of the field.” Certainly in the past, as in the present and future, technological and economic limitations have been barriers to the full implementation of renewable energies; yet in many instances, renewable energy is now approaching cost-parity, and significant policy resources exist to incentivize developments of renewable energy technologies on multiple scales.64

Renewable Energy and Questions of Scale

Simply put, renewable energy is needed at an enormous scale if carbon emissions are to be minimized by 2030 and the most dramatic temperature-related effects are to be avoided. (According to a national defense advisor, it is necessary to start thinking about “Plan B” if we do not make the transition at some speed.65) Scientists have suggested a range of models for energy generation that indicate scenarios in which coal, gas, oil, biomass, solar, wind, and nuclear energy might be used—and in what proportions—for power generation by 2100. By comparing multiple models, one study reaches well-grounded conclusions about the profile of energy use needed in 2100 to remain below a 2°C temperature increase.66 They argue

65 Rear Admiral David Titley (ret.), personal communication (July 29, 2014).
that if the planet is to have a 70% chance of remaining below a 2°C temperature increase by 2100, then by 2100 the global energy supply must use 50%-75% renewable energy. This is a significant shift from current practice: for example, in the United States in April 2014, renewable energy provided about 10% of total energy produced.\(^{67}\) Haste in moving toward renewable energy is essential—yet reform in energy sectors is blocked at various levels of governance and confounded by lobbying and corporate action.

Thus deploying existing technologies is only part of the problem; a considerable aspect of U.S. recalcitrance in moving towards renewable energy sources has to do with political economy, existing infrastructure and management of utilities, and an entrenched fossil fuel lobby in the United States. These social, economic, and political realities represent resistance from an energy regime whose growth is decelerating relative to renewable energies.\(^{68}\) According to a 2013 U.S. Department of Energy report, four technology revolutions have occurred in the last five years, namely: onshore wind power, a variety of new polysilicon photovoltaic modules for solar power generation, LED lighting, and electric vehicles.\(^{69}\) These advances have been accompanied by “dramatic reductions in cost” and surges in consumer, industrial, and commercial deployment. Although these four technologies still represent a small percentage of their total markets (e.g. electricity, cars, and lighting), they are growing rapidly. Hydropower has also been put forward as a renewable energy source, as have emerging sources such as biofuels. Though treatment of these sources is beyond the scope of this paper, it is important to note that there are significant sustainability and resource-use concerns about both hydropower and biofuels.\(^{70}\)

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Wind and Solar

Use of wind energy is growing at an approximate rate of 25% annually. The Department of Energy estimates that 10-20% of projected U.S. electricity demand could be met by wind power by 2030. Deployed wind power has the equivalent generation capacity of about sixty large nuclear reactors, and it accounted for more new electrical generation capacity than any other source in 2012. Advances in both technology and management/distribution structures are needed to address intermittencies and the disincentives limiting municipal or regional utilities’ shifts to clean power. Yet wind has great promise: “Wind is the first non-hydro renewable energy source to begin to approach the same scale as conventional energy forms like coal, gas, and nuclear.”

Solar photovoltaic technology is rapidly approaching cost parity with traditional electrical generation in many parts of the world and the U.S. Through these cost reductions and technological revolutions, formerly real barriers of renewable energy’s cost are becoming merely perceived barriers. Here, too, electricity storage and intermittencies are present challenges (though battery technology is rapidly improving), as is the challenge of lost income for utility companies under conditions of distributed electricity generation. In addition, while solar and wind “burn” more cleanly than fossil fuel sources, the mechanisms and infrastructure for transmission and storage require mining of finite, rare earth materials. Truly renewable energy sources will need to account for the full costs of such technologies beyond the solution of the carbon problem.

Powering Vehicles and Improving Energy Efficiency

Clean vehicles are essential since vehicles create 28% of greenhouse gases. A clean vehicle transition thus has a non-trivial effect. To support wider use of electric cars, a more robust electrical grid and network of EV charging stations will be needed, which are already visible on some highways. Lower-carbon synfuels provide cleaner transportation options as well, though biofuels involve their own sets of complications, as does compressed or liquid natural gas. Public

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transportation should be expanded and developed in alignment with standards of renewability and sustainability.

Energy efficiency is also an important area of growth and innovation. Energy experts consider improved energy efficiencies to be equivalent to a new source of energy since they decrease the amount of fuels required. A major example is improvements in new and existing buildings, which create a significant proportion of greenhouse gases. Sustainable developers are working toward zero-emission or even negative-emission buildings, while polls show that many U.S. residents increasingly choose walkable communities over long commutes for life satisfaction.74

The Necessity of Policy Support

A 2013 Department of Energy report notes the critical role of government support to create energy options for the future, citing how “the U.S. federal government’s production incentives for shale gas and support for new drilling technologies laid the foundation for that industry’s dramatic rise” between 1980 and 2002. In the same way, “well-designed federal and state incentives and investments in research and development have the potential to stimulate significant energy transformations.”75 Surveys indicate considerable public support for these government initiatives.76

Access to Affordable Energy

“Energy poverty” is a reality, even in the United States; it means that a household spends 10% of its income on energy. Households enduring extreme energy poverty spend 20% or more of their income on energy. In 1981, the Bishops emphasized that “given the inequalities that pervade American society, fairness may also require active assistance to those whose voice is rarely heard in policy discussions.” In current political debates, the option for the poor is referred to in terms of the “Matthew 25 criteria” that budgetary Catholic social teaching strongly endorses the goals of creating affordable, clean, secure energy and supporting working families and low-income households. Energy costs must be accessible and allocated fairly in light of the needs of the materially poor and the development of economies globally.

decisions should be evaluated upon the basis of how they affect persons in or near poverty.

From a civic and moral perspective, affordable energy is essential for lower-income households. Households making less than $60,000 a year spend a higher percentage of their income on home heating and transportation, and have less capital available to invest in efficiency or new technologies; these households often change their food buying habits due to higher energy prices.\(^\text{77}\) Initiatives including vouchers, guaranteed loans, and other incentives empower consumers to purchase energy-efficient cars, appliances, and home renovations. Such initiatives have reduced families’ energy bills by more than 20%, reduced demand on the power grid, and created jobs.\(^\text{78}\) Faith communities can play a vital role by advocating for efficiency programs and enrolling low income households in them.\(^\text{79}\)

Conservation can be as valuable as efficiency, but concern for high profit margins frequently obstructs energy-conservation measures.\(^\text{80}\)

Positively, utilities that provide periodic reports to homeowners comparing their usage to other regional users encourage energy conservation.\(^\text{81}\)

**MAKING THE TRANSITION: MOVING TOWARD NECESSARY DEPLOYMENTS**

A low-carbon world requires both disinvestments in fossil energy infrastructure, and increased investments in solar and wind power. Estimates suggest that global society needs to invest $800 billion annually to avoid widespread, intense climate disruption. The United States has an investment gap of $110 billion annually.\(^\text{82}\) Delay will only increase the cost. “We cannot afford to lose another decade,” says Ottmar Edenhofer, a German economist and IPCC report co-chair. “If

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\(^{78}\) Margonelli, “Practical Pieces of the Energy Puzzle.”

\(^{79}\) Rev. Fletcher Harper, GreenFaith, personal communication (August 6, 2014).

\(^{80}\) Education and incentives for sustainable renovations are also needed to support contractors’ knowledge of sustainable building with standards, licensing and testing.


we lose another decade, it becomes extremely costly to achieve climate stabilization.”

While $800 billion for investment in renewables is a very large figure, it is put into context by comparison with current subsidies for fossil fuels. The International Monetary Fund and International Energy Agency report that direct subsidies for fossil energy and fossil electricity totaled at least $480 billion in 2011—six times the subsidies for renewables in 2011. The latest IEA reports show that subsidies in 2014 amounted to $550 billion. This is a large pool of funds whose better use in renewable energy investment must be evaluated. Super-developed nations like the United States must step into leadership roles in advocating for a shift away from fossil fuel subsidies and towards renewable energy subsidies. “Business, investors, activists, and scientists alone cannot change the way we produce and use energy…. Public policies that create markets, remove barriers, level the playing field, and establish clear objectives and targets for renewable energy and energy efficiency help shape the future.”

Consider, too, that the costs of shifting to renewable energy globally have been assessed at between 2-6% of GDP. By comparison, the Apollo project cost 4% of GDP. Digging London’s sewer system after its third deadly cholera outbreak in 1864 took 2% of GDP. The justification for investing in a sustainable planet is equally valid, and from the point of view of Catholic moral teaching, an essential response in justice and stewardship.

Moreover, these are technologically feasible transitions with energy-positive outcomes for many generations: “The world is tapping only a small amount of the vast supply of renewable energy resources

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87 Mogens B. Mogensen, “Closing the Carbon Cycle with Air Capture,” Annual Conference, Lenfest Center for Sustainable Energy (Columbia University, April 2014).
worldwide, with the technical potential of renewable energy several times greater than global energy demand.”\textsuperscript{88} If properly incentivized and developed, renewable energy could provide up to 77\% of global energy needs by 2050.\textsuperscript{89} Studies increasingly demonstrate that barriers are not technological, nor even always economic, but are significantly socio-political.\textsuperscript{90}

Insofar as “one of the biggest hurdles to overcome on the path to energy system transformation and the 2°C target will be to mobilize the necessary investment flows, particularly in light of competing demands for capital within the energy sector,” then this hurdle represents an opportunity for moral leadership and moral conscience in Catholic communities.\textsuperscript{91}

Developed nations will need to assist the developing nations in their transition to more sustainable technologies. The International Energy Agency confirms that “managing this transition will be more difficult for some countries or power systems than others…. Integration is not simply about adding wind and solar on top of ‘business as usual’. We need to transform the system as a whole to do this cost-effectively.”\textsuperscript{92} Because of varied geography, nations vary in their capacity to produce wind and solar energy, just as they do in their access to oil and natural gas. For these reasons, it has become increasingly necessary for the nations of the European Union to collaborate in linking their energy networks if they are to meet their goals for sustainable energy. Fair technological transfer mechanisms are essential.

The United States should lead by example in developing its own sustainable technologies and assisting developing nations fairly, conscious of its carbon debt and the significant ingenuity and investments of developing nations. Against a paltry U.S. legacy in international climate negotiations, positive steps have begun to emerge. In November 2014, the United States and China announced long-range efforts to achieve deep decarbonization of the global economy. These actions

\textsuperscript{88} El-Ashry, “National Policies to Promote Renewable Energy,” 112.
signify the mutual cost-sharing and commitment needed to create a successful new climate agreement in Paris in 2015.93

In future negotiations, the United States must play a leading role in advocating for emissions reductions and the adoption of more sustainable technologies, while also allowing for the integral development of the developing nations. Solidarity calls for assisting the developing nations of the world to achieve the economic growth needed without unduly contributing to climate change. Finally, the U.S. must collaborate with its neighbors to promote the free flow of sustainable energy.

*The Principles of Justice and Subsidiarity*

In a recent statement on energy from the Pontifical Council for Justice and Peace, Bishop Mario Toso stressed that “in view of the realization of peace—and peace includes several goods—it is necessary that energy be thought of, produced, distributed, and used, according to a new paradigm.”94 This new paradigm calls for assessing social cost in tandem with economic cost. The category of social cost should be further studied and highlighted as an essential component of authentic and honest energy calculations.95

Protecting Catholic values of life, human health, dignity, and participation in decision-making requires the full accounting of social costs and strict externality pricing.96 Communities of color in the United States and many industrializing regions in the global South bear disproportionate impacts of climate change and environmental toxins.97 Externality pricing is especially essential to accurately and fairly register the impact of climate change upon those most vulnerable. The Bishops acknowledge in their 1981 statement that the energy

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95 Scott Barrett, “Some Thoughts on Air Capture and Climate Policy,” Annual Conference, Lenfest Center for Sustainable Energy (Columbia University, April 2014).
crisis involves socioeconomic systems and structures that are affected by human sin and finitude. Since then, CST has only amplified these analyses to describe how structural sin has ecological, political and cultural dimensions. Christians seeking to respond actively to this crisis must therefore clear-sightedly analyze ways that structural sin is incentivized within the socioeconomic energy status quo, while also articulating how the structural dimensions of energy connect ethically to the responsibilities of particular persons and communities. U.S. residents are especially called upon to assess the meaning of solidarity in an era of structural sin, particularly with regard to the valuation of profit over human life or ecosystem integrity.

**Action Items**

Every American makes energy decisions within his or her sphere of influence. Individuals personally and with others should consider how they use energy and how to use it more wisely and appropriately in their residences, workplaces, parishes, neighborhoods — wherever they can make decisions. Such discussions provide significant and transformative local leadership. All can strive to increase the proportion of renewable energy they purchase and increase the energy efficiency of their homes and purchases, as well as choose lower-carbon transportation and local food. To support the right and obligation to make informed and ethical energy decisions, energy suppliers should transparently account for the full social cost of energy, while public leaders and legislators should work to prevent suppression of information.

At their most robust, regional and national policies should also strive to support walkable communities, help low-income consumers purchase renewable energy, expand public transit, support innovation and regional growth, and rebuild the middle class with high-wage,

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98 Public understanding of corporations’ infrastructures, profit strategies, and interactions with governments is much greater than in 1981, evident in Occupy movements and public discussions of “the 99%.”


100 The concept of solidarity and an awareness of its good has since 1981 become a much more broadly discussed concept, both within and outside of Catholic social thought. See the historic overview of solidarity in Jame Schaefer, “Solidarity, Subsidarity, and Preference for the Poor” in *Confronting the Climate Crisis: Catholic Theological Perspectives*, ed. Jame Schaefer (Milwaukee: Marquette University Press, 2011), 389-425.

skilled jobs, which are produced by the advanced engineering and manufacturing of an economy driven by a revolution in low-carbon productivity. Similar policy revolutions must take root in the agricultural sector as well, given the intersections between industrial agriculture and the fossil fuel economy.102

GLOBAL LEADERSHIP

Cooperation over resources and the goal of renewable energy societies and economies can build bonds between nations.103 As the Bishops stated in 1981, the U.S. is called to “open-hearted cooperation in the effort to develop a global policy to bring about future energy security.” More recently, Pope Benedict XVI warned that “the risk for our time is that the de facto interdependence of people and nations is not matched by ethical interaction of consciences and minds that would give rise to truly human development,” and—referring specifically to the energy problem—he adds that “there is a pressing moral need for renewed solidarity.”104 Solidarity is, in the famous words of Pope John Paul II, “a firm and persevering determination to commit oneself to the common good; that is to say to the good of all and of each individual, because we are all really responsible for all.”105 U.S. energy policy, foreign policy, and the actions of all citizens should encourage collaborative efforts to face and solve these global challenges.106 The Catholic Church in the U.S. has a unique capacity to be prophetic in this complex situation, by clearly linking principles and exhortations to solidarity to strategies that help Christians to undertake sustained reformations of energy policy. Such clear moral leadership demands a more piercing analysis of “institutional inertia” and its power over everyday life and a serious dedication to transformative pedagogy and practices at all levels of the church’s institutions and among its people. This essay has sought to be one such contribution towards an energy ethic.

103 The Israel–Jordan water agreement shows how water scarcity can be viewed as a “common threat” that drives cooperation between states otherwise in conflict. India-Pakistan’s water agreements have survived multiple kinetic conflicts. David Titley, personal communication (July 29, 2014).
104 Benedict XVI, Caritas in veritate, nos. 9 and 49.
105 John Paul II, Sollicitudo rei socialis, no. 38.
CONCLUSION: GENUINE HUMAN FLOURISHING

The commitment to building an energy future is not simply a technical one, nor is it simply a matter of policy agreement. It also requires, in many ways, a kind of spiritual recognition of a necessary religious response and ethical transformation. The hope that dwells in concepts such as the “American dream” is actualized with the dreams of other human beings, their rights to a clean environment, and the flourishing of the planetary whole.

The 1981 statement exhorts U.S. Catholics not to “heedlessly exploit” and “destroy” nature but rather to “communicate with nature as an intelligent and noble master and guardian.” Our most egregious practices of energy consumption and distribution were not intended to destroy nature. Nonetheless, the practices in our present energy paradigms commit us to the exploitation of finite resources and climate change. And while fossil fuels are central to the lifestyle and economy of the contemporary United States and most countries worldwide, and energy sovereignty is a worthy goal, there are energy alternatives to fossil fuels. Thus, while fossil fuels are currently inextricable from contemporary life, they need not always remain so. In principle and increasingly in practice, other kinds of energy sources—such as wind or solar—can fill the energy-generating niche.

The present energy crisis presents a moral call to renew our freedom and inventiveness and community spirit to build the global, national, and local communities we desire. Within that call is the summons to examine our understanding of genuine human flourishing.

Genuine Human Fulfillment

The American dream expressed in our national hymn, “America the Beautiful,” is about genuine human fulfillment, seeking prosperous and just communities in our beautiful land. It is not about overconsumption and waste, its commercialized substitutes. Recall the magisterial critiques of super-development, which John Paul II called “an excessive availability of every kind of material goods,” which makes people “slaves of possessions and immediate gratification, with no other horizon than the multiplication or continual replacement of the things already owned with others still better.”\(^\text{107}\) This message about what truly fulfills us as individuals is increasingly reinforced by the scientific literature of happiness studies, which stresses that we are

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\(^{107}\) John Paul II, *Solicitudo rei socialis*, no. 28. He offers similar critiques in *Centesimus annus*. 
fulfilled by relationships and a sense of skill and empowerment in our own lives.108

Addressing overburdened working families, social recession, unemployment, and a loss of social capital depends on an ecological macroeconomics based on a “new economic and social logic.”109 This secular statement of economic pragmatism and community solidarity echoes the Bishops’ call for freedom in altering our lifestyles and reimagining the structures of healthy and just families and communities.

In addition, gratitude for life is a starting point for religious renewal that draws on joy. The Psalms reflect on the spacious skies as the heavens which proclaim the glory of God, the sacramentality of our beautiful earth through which we experience the presence of God. Environmental writers like John Muir,110 Aldo Leopold111 and Rachel Carson112 have demonstrated the power of gratitude as they described their environments with overflowing enjoyment. In that way they were able to awaken Americans to their own interconnectedness with the land. American Catholics can also look to virtue ethics’ focus on flourishing to re-envision our relationship with energy in the context of creation.113 The mindful practice of interdependence centered on God as sustainer and giver of life enables us to see, judge, and act vis-a-vis

The American dream is not about excess, consumerism, and waste. The authentic foundation of the American dream is that God prospers our hopes for a better life, for peaceful, fair and prosperous communities.


109 Sustainable Development Commission, _Prosperity Without Growth? The Transition to a Sustainable Economy_ (London, 2009), 90.

110 See, for instance, John Muir, _Nature Writings: The Story of My Boyhood and Youth; My First Summer in the Sierra; The Mountains of California; Stickee; Selected Essays_ (New York: Penguin Books, 1997).


energy scarcities “as creatures and as fellow creatures,” as the Bishops’ statement characterized humanity.

Seeking to bring these insights into practice, Catholics may strive for the anticipated, just and sustainable future through the spiritual practices that rekindle a passion for the flourishing of all life—characterized by equity. The faces of those who lack the resources to meet even their most basic needs, or the traces left by extinct populations of animal and plant life, echo this plea to encounter God so that we claim our true identity as creatures.114 Created in the image of God, we are also called to image God’s creativity, as co-creators of beauty and sustainable forms of living—across geographic boundaries as well as with respect for future generations.